LEOSPHERE
Lidar Environmental Observations

EZ AEROSOL AND CLOUD LIDAR

ALS300 & ALS450

USER MANUAL

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Document Purpose

This document is intended to describe technical information, security cautions and operational instructions that are necessary to efficiently operate the EZ LIDAR system manufactured by LEOSPHERE SAS.

Revision Records

Version	Date	Affected	Change	Justifying
01/00	13.12.2005	All	All Paragraphs	First Edition
02/00	25.01.2006	All	Overall Review of the Document	I.S. Stachlewska
03/00	15.03.2006	IV	Chapter IV. LIDAR Operation	M. Lardier
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06/05	01.12.2007	All	Update for the ALS 2.2	M.Lardier
06/06	19.12.2007	All	Software description moved in a separated document	O.Petilon
06/07	05.04.2008	All	Overall Review of the document	S. Dubois
	15.12.2009	All	Overall Review of the document	L. Mahé
	25/12/2009	VII	Using the Casing	A. Trimouille

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PREFACE

We would like to thank you for choosing the EZ Aerosol LIDAR for your scientific and/or industrial activities. This LIDAR has been designed to ensure you reliable and easy ways to measure atmospheric parameters. We wish you a lot of success in its use and hope that your system will highly contribute to your research endeavours.

The EZ LIDAR product line guarantees a high level of user-friendliness and requires no need of specific knowledge about LIDAR technology. The system provides a consistent measurement of the extinction coefficient without any additional development or setting from the user.

This document encloses the technical information required to handle, operate and maintain the EZ Aerosol LIDAR in a proper and safe way.

All Users of the EZ LIDAR are obligated to receive a training provided by LEOSPHERE or by a trainer certified by LEOSPHERE, to read the EZ LIDAR Users' Manual.



The Caution Labels: In accordance with CDRH and CE requirements the Caution Labels are prominently displayed on the EZ LIDAR Optical Head and on the control unit. These cautions may exceed the actual level of hazard of the EZ LIDAR system itself but apply to its inner components that are individually marked with such caution labels.

The Laser Radiation Label: The Laser used in the EZ LIDAR produces radiation hazardous for eyes and skin. It can cause burning, fires and vaporize substances. Please refer to the safety chapters of this document and of the Laser User's Manual, as both contain essential information and guidance about the mentioned hazards.

Acknowledgements

- The EZ Aerosol LIDAR technology has been developed in cooperation with the Climate and Environment Sciences Laboratory (LSCE, CEA/CNRS, FRANCE).
- The LSCE has patented the design of the instrument and granted an exclusive license for the manufacturing of the EZ Aerosol LIDAR to LEOSPHERE.
- LEOSPHERE and EZ LIDAR are registered trademarks.

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1. GENERAL INFORMATION

1.1. PRINCIPLE OF THE EZ LIDAR TECHNOLOGY

The LIDAR (**Li**ght **D**etection **A**nd **R**anging) principle (see Figure 1.) is based on the scattering phenomenon of light. A Laser pulse is sent into the atmosphere and scattered by a target molecules or particles (clouds, dust, soot particles etc.). The backscattered light is collected by an optical system and its intensity is measured by a photo-detector. The amount of the collected optical radiation is converted into an electronics signal and stored onto a computer. The time for the light pulse to travel out to the target and diffuse back to the EZ LIDAR is thereby used to determine the range to the target. Different types of deliverables are assessed from the measured level of electrical signal using various dedicated post-treatment algorithms (see EZ Aerosoft User Manual).

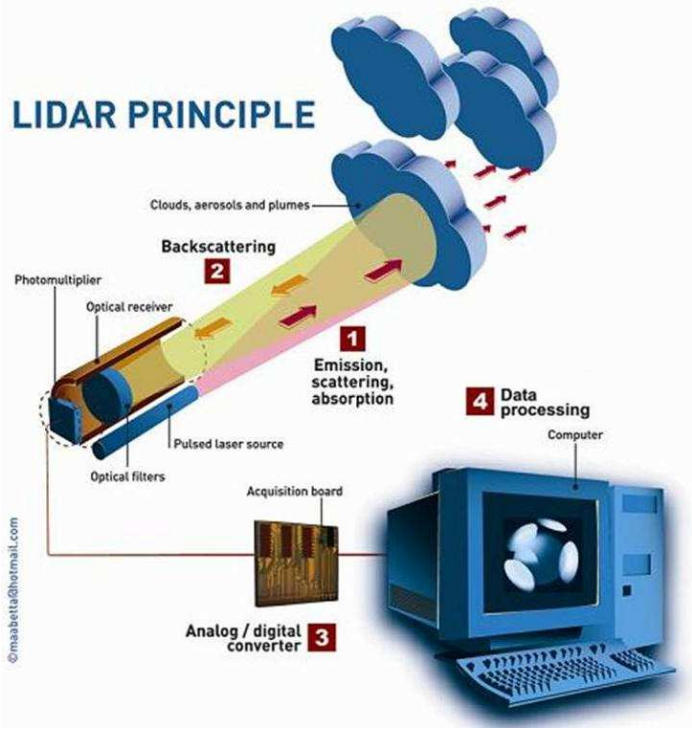


Figure 1: Measurement Principle of the EZ LIDAR

1.2. EZ LIDAR – BLOCK DIAGRAM AND LABELS

The EZ LIDAR is composed of three main elements linked together (see Figure 2):

- The Optical Head - containing the Laser emission and optical receiver modules.
- The Control Unit - containing the EZ LIDAR electronics control and acquisition units.
- The Thermal Regulation Unit - containing heating and/or cooling system.

Additionally the EZ LIDAR might include optional units as for instance:

- The Automatic Scanning System

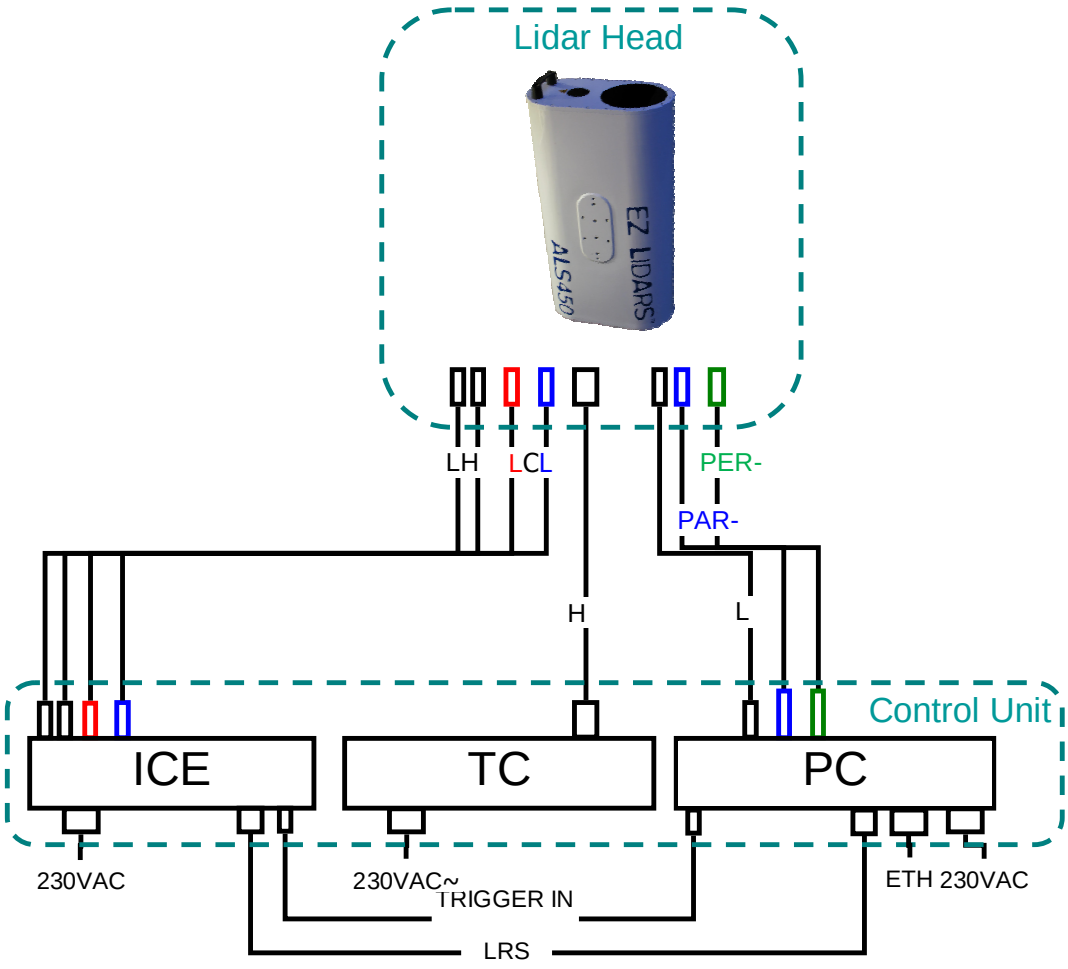


Figure 2: EZ LIDAR Block Diagram

1.2.1. EZ LIDAR UNITS

The Optical Head:

LH	Laser Head
PMT	PhotoMultiplier Tube (PMT) Detector
TRS	Thermal Regulation System

The Control Unit:

ICE	Laser Integrated Cooler and Electronics Unit
PC	Industrial Computer
TC	Thermal Controller

EZ LIDAR Cables

LCL	Laser cooling lines (b - blue, r - red)
LHV	Laser high voltage & data transfer cable
PAR-SIG	Parallel Channel Signal
PER-SIG	Depolarisation Channel Signal
LV	Low voltage cable
HV	High voltage cable
TS	Temperature sensor
HC	Heating cable
TRIGGER IN	Trigger signal (from the Laser Q-switch Synchronisation to the PC)
TRIGGER OUT	Trigger signal (from the PC to the Acquisition board)
LRS	Serial laser control (RS232)

1.3. EZ LIDAR – SPECIFICATIONS

Laser Specifications		
Wavelength	355 nm	
Frequency	20 Hz	
Output Density of Laser Energy (EN60825-1 threshold: 47.8 J/m^2)	30 J/m^2	
Output Laser Energy	16 mJ	
Detection Specifications		
Range	ALS 300	From around 200 m (Full Overlap), to 9 km (30 000 ft).
	ALS 450	From 200-300 m (Full Overlap), to 15 km (45 000 ft).
Spatial Resolution (Minimal)	1.5 m (Raw data) – 15 m (Deliverables)	
Temporal Resolution (Typical)	10 – 30 s	
Weight/Dimensions of the Optical Head (with ENVIDUR)	17 kg - 65 x 35.6 x 19 cm	
Weight/Dimensions of the Control Unit	50 kg - 70 x 60 x 60 cm	
Power Supply Specifications		
Electrical Power Supply	230 VAC	
Power consumption (with heaters)	550 W (Average) (Crest at Startup)	
Power consumption (with air conditioning)	1000 W (Average) (Crest at Startup)	

Table 1: EZ LIDAR Specifications

2. SAFETY, REGULATIONS AND LIABILITIES

The EZ LIDAR is compliant with the regulations related to its product category, which means:

- All electronics and optoelectronics components of the EZ LIDAR are CE marked.
- The EZ LIDAR has been designed to comply with EN 60825-1 regulation regarding eye-safety.

Keep in mind that the Laser itself is not eye-safe, and requires a careful handling as described below. Then, it is mandatory to read the Laser user manual before operating the EZ LIDAR.

Meaning of the used Caution Labels:

Caution! Risk of exposure to hazardous Laser radiation.

Caution! Risk of electric shock.

Caution! Call attention to a procedure, practice or condition that could cause damage to the product or cause bodily injury to the user.

2.1. LIDAR OPERATION

Before powering up and operating the EZ LIDAR you should thoroughly read this description. To operate the system it is important to fully understand its main features and controls. The use of controls, adjustments and procedures other than specified in this manual might result in hazardous radiation exposure, system damage or voiding the warranty.

Before connecting the Main Power Supply and operating the EZ LIDAR you must make sure that:

- The Laser Coolant Lines have been properly connected between the EZ LIDAR Optical Head and the back of the ICE unit.
- The coolant reservoir has been properly filled in with the appropriate coolant, i.e. distilled water (Resistivity > 200 000 Ohm·cm, total amount of germ < 10 UFC/100 mL).

2.2. LASER RADIATION HAZARDS

The EZ Aerosol LIDAR is an eye-safe system though it uses a class IV Laser as a light source. Direct long exposure of skin and eye to UV radiation can be dangerous, as it might cause cancer.

- Avoid long and direct exposure of skin and eye to the Laser UV radiation. It can be dangerous as such exposure might cause cancer!
- Avoid putting hands into the invisible beam and use fluorescent screens, like a piece of white paper, to define the Laser beam!
- The EZ LIDAR includes a powerful Laser. Its eye-safety conditions are ensured by optical means. It is strictly forbidden to modify the optical function of the EZ LIDAR, by adding focusing optics in front of the EZ LIDAR Optical Head!

2.3. MECHANICAL SAFETY

Mind the heavy weight of the EZ LIDAR and its main elements. Be cautious while setting up the Optical Head on the Electronics Casing.

2.4. ELECTRICAL SAFETY

- Mind that the Laser Head and the ICE contain electrical circuits that operate at lethal voltage and current levels!
- Before any transportation, always unplug the EZ LIDAR system Mains connection and wait at least 1 minute to allow capacitors to discharge!
- Always unplug cables between the Optical Head and the Control Unit before servicing any part of the EZ LIDAR system!
- Avoid spilling cooling liquid on the Control Unit. Clean up spills immediately!
- Always check Mains voltage for proper grounding! Poor ground quality might result in exposure to electrical shock!
- Only if the Safety Circuit-Breaker is available and switched ON, connect the EZ LIDAR system to the prime power and check the power supply's grounding. Poor ground quality might result in exposure electrical shocks, which would damage the EZ Lidar's electronic components.

2.5. EZ LIDAR LIMITS OF USE

The EZ LIDAR systems supplied by LEOSPHERE are intended to be used for scientific measurement purposes only!

- LEOSPHERE cannot be liable for any damage that may occur due to the operations that are not detailed in this document!
- In no case the LEOSPHERE LIDAR devices are designed or guaranteed for their use in any other activity, or process, above all those dealing with human safety!
- The detection sensor included in the system is a very sensitive device. Although there is a specific design to protect it, the measurement of the direct sunlight can temporarily blind or even none reversibly damage the detector. The EZ LIDAR Optical Head should never point towards the sun!

3. INSTALLATION

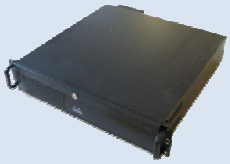
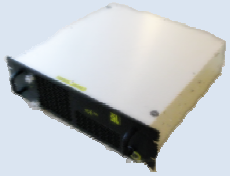
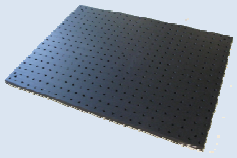
3.1. INITIAL INSPECTION AND UNPACKING

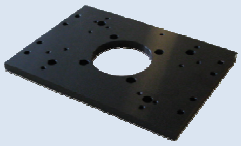
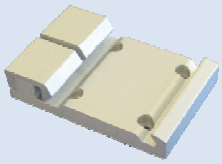
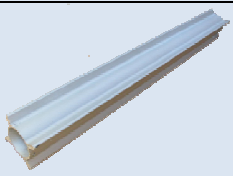
All EZ LIDAR components and cables were tested, used in real conditions, carefully inspected and packed before shipping.

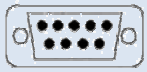
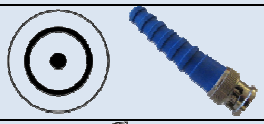
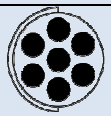
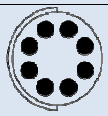
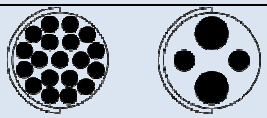
Unpack each part of the system and carefully inspect for any visible damage. If any of the parts are damaged, please contact LEOSPHERE as the parts could be damaged in transit.

Retain all packing slips and shipment information in case a claim needs to be submitted to the carrier.

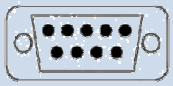
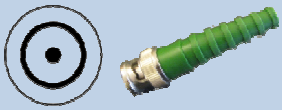
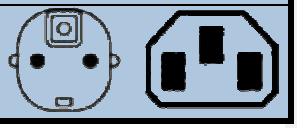
3.2. PARTS LIST

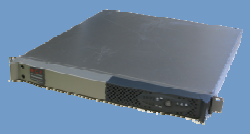
Standard ALS	1 Optical Head (2 Small Caps)	
	1 Industrial Computer	
	1 Laser Supply and Control Unit	
	1 Laser Remote Control	
	1 Temperature Control Unit	
	1 Optical Head Supports	
	1 400x600 Base Plate	

Standard ALS	1 220x160 Adaptation Plate		
	1 Optical Head Maintaining Plate (if no Scanning Device)		
	1 Extrusion Profile		
	1 Hypalon Sleeve		
	Filling Kit	1 Filling Bottle	
		2 Hoses (1 Medium Cap Each)	
		2 1L Bottles of Distilled Water	

Standard ALS	3 Power Supply Cables		
	1 COM RS232 Cable		
	1 Blue Coaxial Cable		
	1 7-pin PM Supply and Control Cable		
	Laser Cables	2 Cooling Liquid Hoses (1 Red/1 Blue) (2 Medium and 2 Big Caps)	
		1 8-pin Heating Cable	
		1 19/4-pin Laser Supply Double Cable	
	2 Trigger BNC Cable		
	Fastening Kit	4 M6x12 CHC Screws (if no Scanning Device)	
		4 M6x16 CHC Screws	
		4 M6x20 CHC Screws	
		4 M4x12 CHC Screws (Qty x2 if Casing)	

Standard ALS		
	1 Connectors Protection (Qty x2 if Casing)	
	1 Interface (Qty x2 if Casing)	
	1 Purge Kit	
	2 Sets of Keys (Computer, Laser Unit and Temperature Unit)	

Scanning Device	1 Scanning Device		
	1 Disk-Shaped Plate		
	1 Slide		
	1 COM RS232 Cable		
	Additional Fastening Kit	2 M6x8 CHC Screws	
		4 M6x12 CHC Screws	
		4 M6x20 CHC Screws	
		4 M6x25 Hexagonal Head Screws	
		4 M6 Nuts	
Depolarization	1 Green Coaxial Cable		
Casing	1 Casing		
	1 Additional Power Supply Cable		

PTU Probe	1 PTU Probe	
	1 PTU Protection	
	1 Tripod (if no Casing)	
GPS	1 GPS Module	
Others	1 UPS (Uninterruptible Power Supply)	
	1 Black Container	
	1 Electric Generator	
Boxes	1 Lidar Head Box 1 Computer and Rack Box 1 Accessories Box	

3.3. HARDWARE INSTALLATION

This chapter describes the installation of the standard system. For hardware installation of the optional components, please refer to the annexes.

3.3.1. THE OPTICAL HEAD

The Optical Head's Mount should be fixed on an existing concrete platform or horizontally leveled surface for the purpose of doing any unattended operation, especially in case of strong weather.

Install the EZ LIDAR system in following steps:

- Assemble the Optical Head's Mount (in fixed or scanning mode), as described in Appendix A.
- Install the Optical Head on its mount as described in Appendix A and as shown in Figure 3.

Figure 3: EZ LIDAR in fixed Mode

- Make sure that all electrical units are switched OFF!
- At first, you must plug the cables at the rear of the Optical Head as shown on:
  - Plug the Laser High Voltage cable & data transfer cable (LHV), the Low Voltage cable (LV), and the data cables (PAR-SIG blue coaxial cable and PER-SIG green coaxial cable), according to the respective labels show on Fig. 4.
  - Plug the coolant lines by connecting the red-labelled hose to the red-labelled connector on the Laser Head. Repeat the same for the blue hose as shown on Fig. 4.

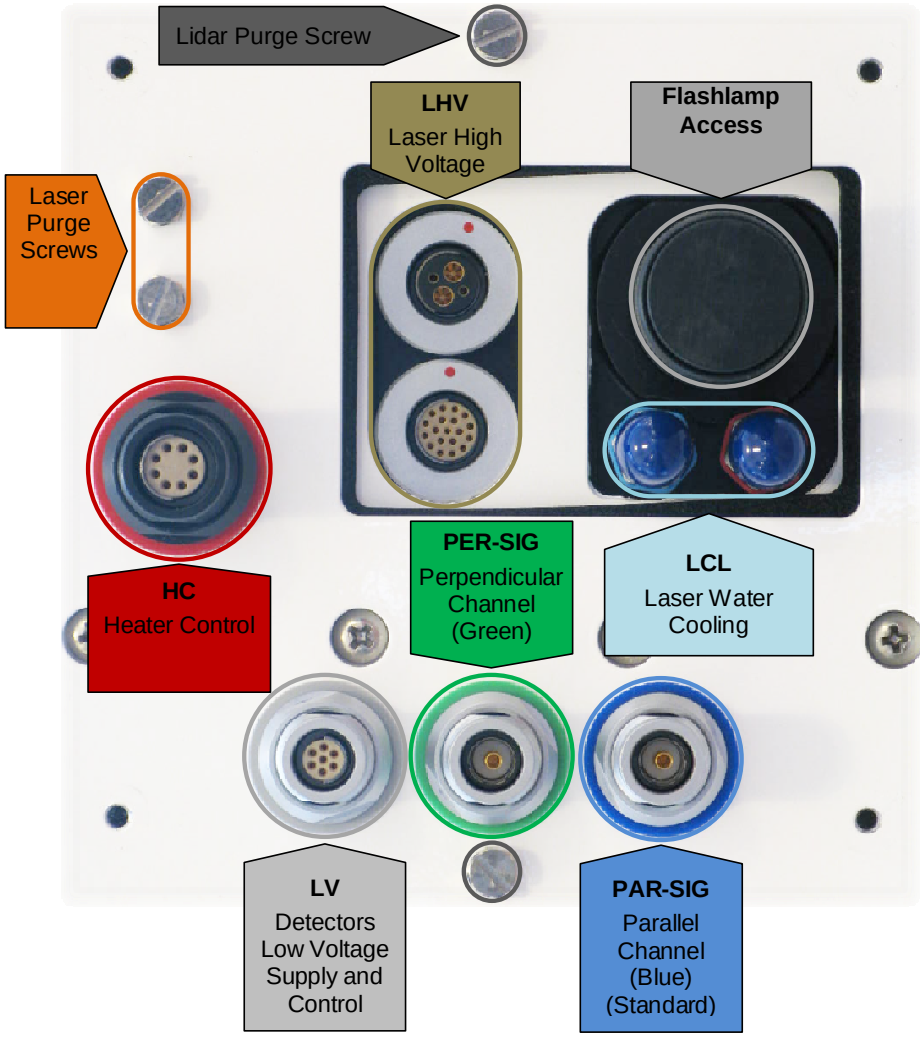


Figure 4: Back Panel of the Optical Head

3.3.2. LASER CONTROL UNIT (ICE)

After you plugged the cables at the rear of the optical head, you need to plug the hydraulic and electrical cables at the back of the laser unit. **Erreur ! Source du renvoi introuvable.** shows the back panel of the laser unit without any cable plugged.

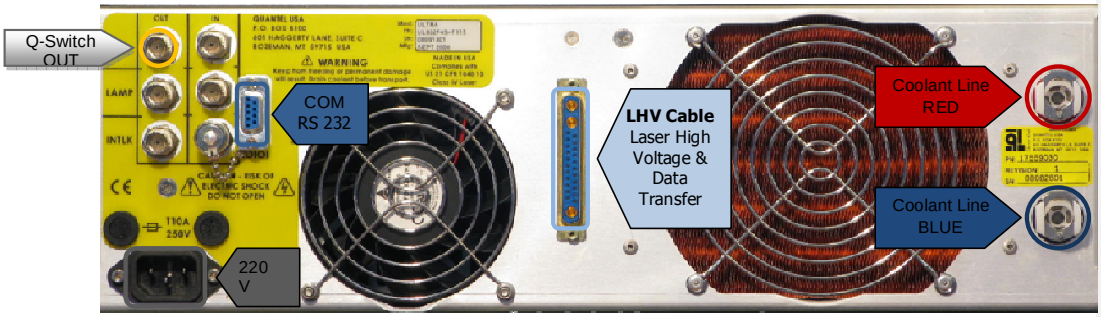


Figure 5: Back Panel of the Laser Unit (ICE)

Read carefully the following paragraph, as it contains essential information for the proper functioning of the EZ Aerosoft.

To permit a good monitoring of the laser by the computer, it is important not to use the remote control: the laser unit is controlled either by the computer or by the remote control, and once a button is pressed, the link between the laser unit and the computer is broken.The serial link could be set by doing the following action on the remote control.

	Configuration 1		main menu			main menu	
	FlashLamp		temp. CG	XX.X°C		temp. CG	XX.X°C
	Q-Switch	>	serial link	OFF	>	serial link	ON
>	System info		Time-out	OFF		Time-out	OFF

Figure 6: Serial Link Activation on the ICE Remote Control

Then, launch the Aerosoft again, and avoid pressing a button on the remote control again.

3.3.3. INDUSTRIAL COMPUTER

After you connected all the cables on the Laser unit, you need to plug all the electrical cables at the back of the industrial computer. Figure 7 shows the back panel of the laser unit without any cable plugged. All the connectors listed must be connected as shown on **Figure 8** and on **Figure 9**.

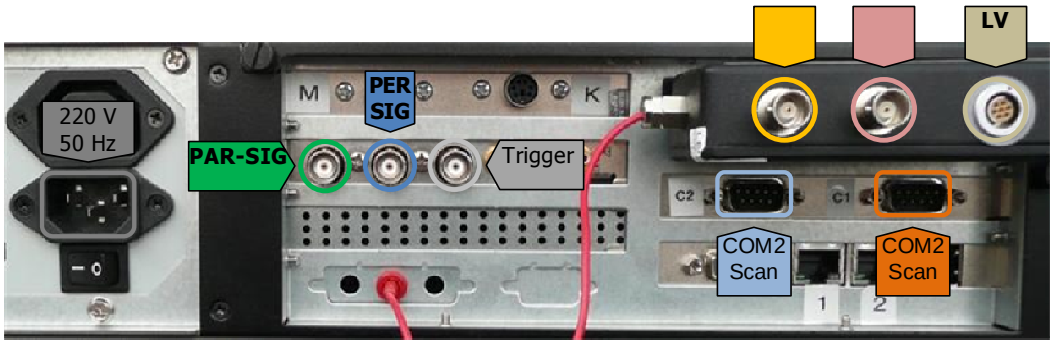


Figure 7: Back Panel of the Industrial Computer (no cable connected)

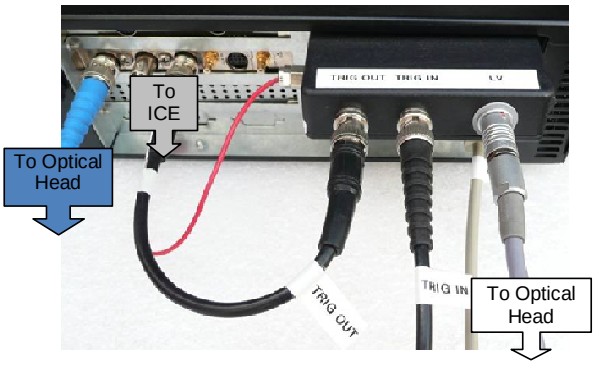


Figure 8: Back Panel of the Industrial Computer (All cables connected)

Figure 9: Back Panel of the Industrial Computer (All cables connected)

Ensure that the proper Main voltage (230V) is available and properly grounded.

Before switching ON, fill in the laser cooling liquid according to the "Cooling liquid fill-in and replacement" procedure (Chapter VII Transportation and Storage).

4. LIDAR OPERATION

The EZ LIDAR Software can be run either directly from the EZ LIDAR PC desktop or by using remote access. Before using the remote access mode, a set-up of network parameters is required in the User Operational System and the EZ LIDAR Software.

Information about the newly released EZ LIDAR software upgrades which are available to the users and the developments are communicated to the EZ LIDAR Users.

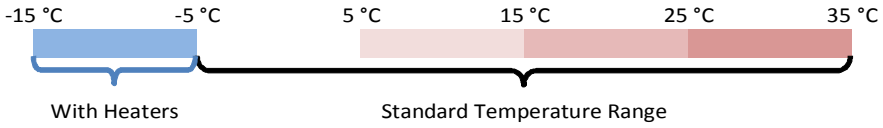
To ensure stable LIDAR operation the ambient temperature must be kept within -5°C and 35°C around the Optical Head and from 15°C to 35°C around the Control Unit.

Between -5°C and 5°C, the signal level might decrease significantly if the LIDAR head does not have thermal regulation.

NOTE: the ambient temperature is defined as the temperature measured around the Optical Head and/or the Control Unit and not as a temperature in the shadow if the Optical Head is under the Sun, for instance.

Operating the EZ LIDAR at an over range temperature might result in permanent Laser damage due to possible Cooling System failure (coolant freezing or boiling)!

NOTE: The operational range of temperature is extended from -5°C to -15°C if your EZ LIDAR is equipped with Heaters.



If the exposure of the EZ LIDAR to freezing temperatures cannot be avoided, each part of the EZ LIDAR Cooling System (the Laser Head, the ICE and the Coolant Lines) must be fully drained according to the 'Draining for Storage and Transportation Procedure'!

To limit hazards due to over range temperatures, the EZ LIDAR may be equipped with the following optional modules:

- The Temperature Controller, which automatically adjusts the temperature of both the Coolant Lines and the Optical Head within the ENVIDUR™ enclosure.
- The Hardware Protection Module, which stops the measurement or shuts down the EZ LIDAR when the temperature inside the Control Unit and/or the Optical Head exceeds the mentioned operational ranges.

4.1. EZ LIDAR SWITCH ON

Before starting the data acquisition make sure that:

- The emission and detection windows of the EZ LIDAR Optical Head are not too dirty. If necessary, clean them as indicated in Chapter VI.

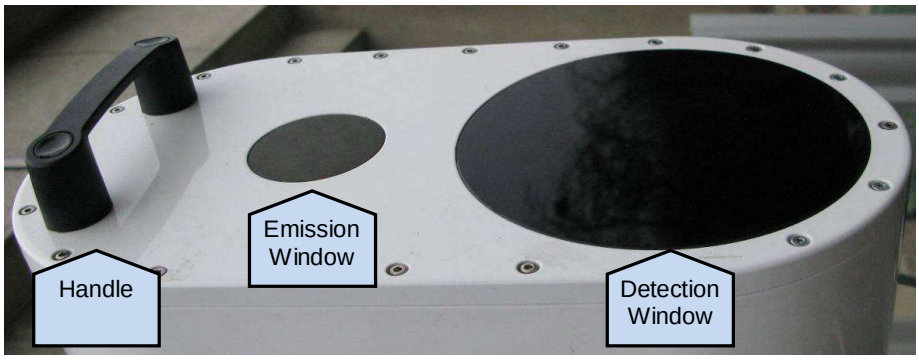


Figure 10: Front View of the Optical Head

- The Optical Head is well connected to the Control Unit and the coolant level reaches the maximum level marker on the front panel of the ICE. If necessary, add coolant as indicated in Chapter VI.

Figure 11: Collant Level Marker

- The Optical Head is well fixed on the EZ LIDAR Mount and placed in an appropriate position.

NB: LEOSPHERE usually recommends tilting the Optical Head by 4° from the vertical direction, to allow rain streaming and to improve the detection of oriented ice crystals when the Depolarisation channel is used for icy cloud studies.

The EZ LIDAR is now ready to be switched ON:

- Switch ON the Laser ICE:
  - Ensure that the Laser Emergency Stop is unlocked by turning counter clockwise the red button.
  - Turn on the Laser Key.
- Look carefully at the ICE remote control, which indicates when the Laser is ready to shoot.

Prior to any data acquisition, the Laser has to be warmed up to ensure its stable operation.

- If the laser has been stopped for a long time (more than 2 hours), it needs a manual warm-up of about 20 minutes before starting the flash-lamp to ensure the temperature stabilization of the laser head. The temperature of the water inside the Laser head, which is displayed on the remote control, must be at least 37 °C.
- Check that the Q-Switch LED is turned OFF (Fig. 10). If not, press the Q-Switch button to disable the laser emission.
- Start the computer (one switch at the back first, and another one in the front).

4.2. SYSTEM ALARMS

4.2.1. THE MAIN POWER FAILURE

The lack of main power can cause the drop of temperature to freezing levels, what could dramatically damage the Laser! This situation must be carefully handled in order to protect the Laser by different means which can be combined:

- Remove the EZ LIDAR system from the freezing environment!
- Restore Control Unit's temperature by auxiliary mean!
- Restore main electrical power as soon as possible!

5. MAINTENANCE

In the following paragraphs the description of the Light and Heavy Maintenance determined by the experience of the LEOSPHERE Servicing Procedures, as well as by the Quantel / Big Sky Laser Technology User Manual, are given. As the Laser User Manual is supplied in the EZ LIDAR package, we strongly recommend reading this manual in addition!

The EZ LIDAR has been designed in a way to reduce the system maintenance to an absolutely necessary minimum.

Maintenance operations are mainly induced by the Laser Servicing Procedures described in this manual. However, two levels of maintenance are required to ensure long lasting operation and extend operation time between failures:

- Light Maintenance, i.e. the replacement of consumables.
- Heavy Maintenance, i.e. the servicing of the EZ LIDAR itself.

5.1. MAINTENANCE OPERATIONS

5.1.1. TRANSPORTATION AND STORAGE

The normal operation of the EZ LIDAR assumes that the system is installed as an autonomous station, so that cables and hoses between the Control Unit and the Optical Head should not been connected/disconnected except for maintenance purpose. Miscellaneous reasons however can lead to connection/disconnection of these two LIDAR units under outdoor conditions, as for example short way transportation of the instrument from one location to another, optimization of the location of measurement, etc.

In all circumstances, it is important to respect the following rules in order to maintain the EZ LIDAR system in a proper way of working!

- Always ensure that the EZ LIDAR is powered off before any transportation!
- Place the EZ LIDAR Optical Head in vertical position with the front of the head pointing towards the ground to ensure that the coolant level inside the Laser Head remains unchanged.
- Disconnect all electrical cables from the Optical Head.
- Carefully disconnect the Coolant Lines from the Optical Head.
- Immediately cover the Laser quick-connectors with small blue caps delivered with the EZ LIDAR to ensure that no dirt particles or dust enter the coolant circuit!
- The Coolant Lines are protected from draining by automatically closing valves so that no dirt part does enter the coolant circuit. However, different plastic and metallic caps are provided to protect cables and hoses' ends.
- Avoid leaving or drugging the disconnected cables and Coolant Lines on the ground even if they are protected.

For both, storage and transportation, the EZ LIDAR system must be completely drained (including all elements, i.e. the Laser Head, the ICE and the Coolant Lines), especially when the system is not used for a long time leading to stagnant water effects!

Always drain the EZ LIDAR system when it is not used and left alone in outdoor or indoor conditions where freezing temperatures might occur! Draining of the system prevents coolant freezing which may cause the damage of the Laser Head and the cooling system!

To drain the EZ LIDAR system, please refer to the procedure described in section 6.2.2.

5.1.2. LIGHT MAINTENANCE

Perform following maintenance on a regular basis!

Cleaning of the optical windows

At least once every month, make sure that the ENVIDUR Optical Windows are not obstructed by dirt and dust particles. Clean these windows regularly with appropriate cleaning fluids and tissues, dedicated to optics care and cleaning (frequency depending on outdoor conditions).

Cooling liquid replacement

Running the Laser Cooling System dry or while the Laser Head is not connected, might cause the pump damage!

Prior to running the EZ LIDAR, the Laser cooling system must be filled with distilled water (see Section 2.1: LIDAR Operation).

The coolant level can be checked at any time through the view port in the front panel of ICE and shall be maintained at the Maximum Level!

Running the Laser Cooling System with low level of cooling liquid may cause the lowering of the energy of the Laser pulse! If the cooling liquid level is not enough, the ICE will emit an unusual noise!

The cooling liquid must be replaced regularly to ensure proper operation and to increase the flash-lamp lifetime. The frequency of this operation depends on the using mode of the EZ LIDAR:

- In continuous mode (i.e. without frequently connection/disconnection operations), the cooling system should be completely drained and refilled every 2 months.
- In the case of frequently connection/disconnection operations, the cooling system should be completely drained and refilled every month.

To drain and refill the EZ LIDAR cooling system, please refer to the procedures described in sections 6.2.1 and 6.2.2.

Deionisation cartridge replacement

Replace the Laser Deionisation Cartridge at least every 6 months! Please refer to the procedure described in section 5.2.3.

Flash-lamp replacement

According to the ULTRA Laser manufacturer (Quantel / Big Sky Laser Technology), for optimal performance, the replacement of the flash-lamp shall be made after every **50 million shots** to maintain the output energy at the original level, depending on the flash-lamp quality. **LEOSPHERE recommends replacing the flash-lamp after every 50 million shots!**

Please refer to the procedure described in section 5.2.4.

After every flash-lamp replacement, the flash-lamp counter must be reset to zero. In the remote control menu, successively enter the flash-lamp menu and the counter unit menu (**Figure 12**):

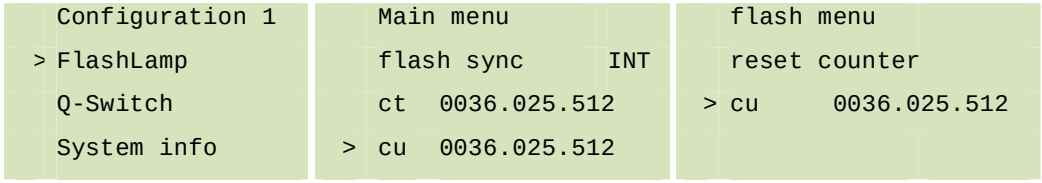


Figure 12: Flash-lamp Counter Reset on the ICE Remote Control

Position the cursor on the cu counter, and press the *ENTER* button to reset the flash-lamp counter.

Note: the "ct" counter refers to the total number of time the laser shot, and the "cu" counter to the number of time the current lamp flashed.

5.1.3. HEAVY MAINTENANCE

It is highly recommended to ensure at least once a year a full check-up of the EZ LIDAR system and all its subunits in order to reduce the risk of breakdown and to extend the product lifetime!

The warranty contract provides assistance in the case of the EZ LIDAR hardware or software breakdown (compare Chapter 8). It does not include scheduled maintenance operations!

In the following table, the maintenance actions that are necessary to be performed every year are given. Additionally, an overview of the various Maintenance Programs offered by LEOSPHERE associated with the particular actions is presented.

		CONTRACT TYPE						
		Warranty 1 year	Hotline 10	Hotline 30	EZ link 1	EZ link 2	EZ link 3	EZ link 4
Support	Remote support 5H ***	☑			☑			
	Remote support 10h (mon-fri / 10am-5pm GMT+1)		☑			☑	☑	
	Remote support 30H (7 days a week / 10am-5pm GMT+1)			☑				☑
Breakdown *	Diagnostic of hardware breakdown (remote/on-site/at Leosphere's premises - within 72 hours)	☑				☑	☑	☑
	Hardware repairment (remote/on-site/at Leosphere's premises)	☑				☑	☑	☑
	Replacement of defective componants (excluding laser unit, photosensor and acquisition cards)						☑	
	Replacement of defective componants	☑						☑
	Remote diagnostic of software breakdown	☑				☑	☑	☑
	Remote software debugging	☑				☑	☑	☑
	Remote software download (same version)	☑				☑	☑	☑
Scheduled **	Remote software upgrades download (+ CD shipment)						☑	☑
	Replacement of consumables				☑	☑	☑	☑
	Liquid outlet				☑	☑	☑	☑
	Sealings replacement				☑	☑	☑	☑
	Cleaning of openings and windows				☑	☑	☑	☑
	Cleaning of inner componants				☑	☑	☑	☑
	Full laser and laser controller check				☑	☑	☑	☑
	Full detection chain check (alignement, electronic sensors)				☑	☑	☑	☑
	Full measurement performance check				☑	☑	☑	☑
	Replacement of defective componants (excluding laser unit, photosensor and acquisition cards)						☑	
	Replacement of defective componants							☑
	Lidar loan during unavailability time							☑

* Diagnostic process is determined by Leosphere
** 1 visit per year
*** includes assistance for the first operations of light maintenance performed by the client
When the replacement of subcomponents is not included in the customer's contract, a budget estimate is sent to the client for validation

Table 2: Warranty Contract Types

5.2. MAINTENANCE PROCEDURES

5.2.1. COOLING LIQUID FILLING PROCEDURE

If the Laser Unit Pump remains stopped for two days in a row, follow the cooling liquid filling procedure before any use of the laser.

Fill in the cooling liquid in following steps:

- Make sure that the Laser is powered off and that all cables and hoses are properly connected!
- Fill in the fill bottle (Accessory kit) with coolant (see **Figure 13**).

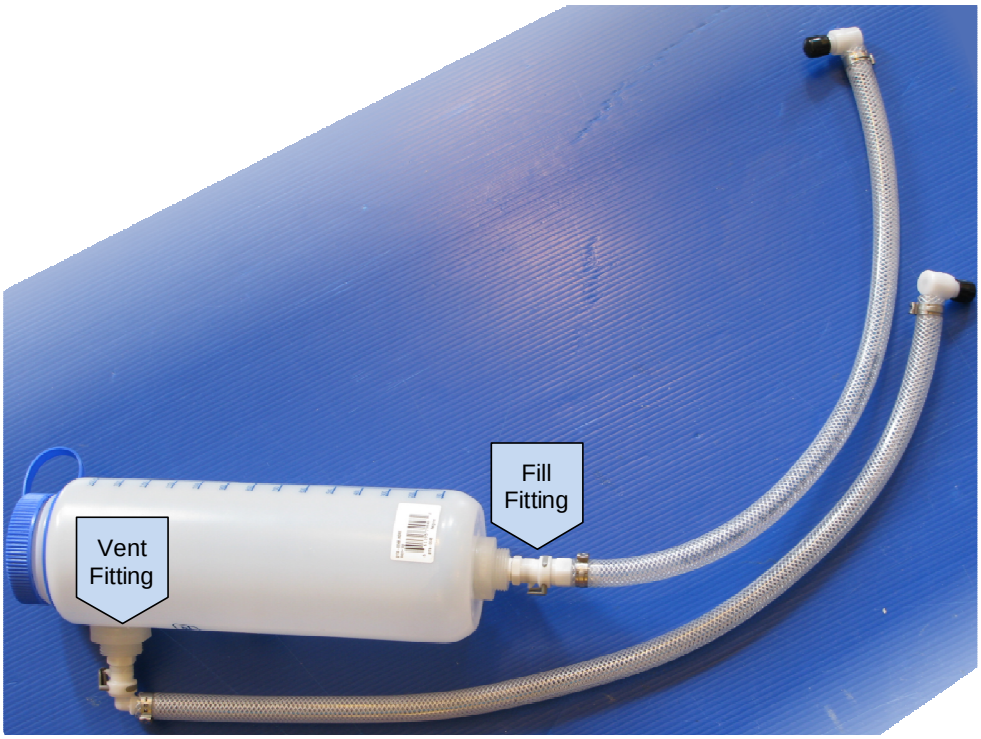


Figure 13: Filling Bottle

- Plug the vent hose of the filling bottle to the upper VENT fitting on the ICE front panel (see **Figure 14**).
- Plug the fill hose of the filling bottle to the bottom FILL fitting on the ICE front panel (see **Figure 14**).

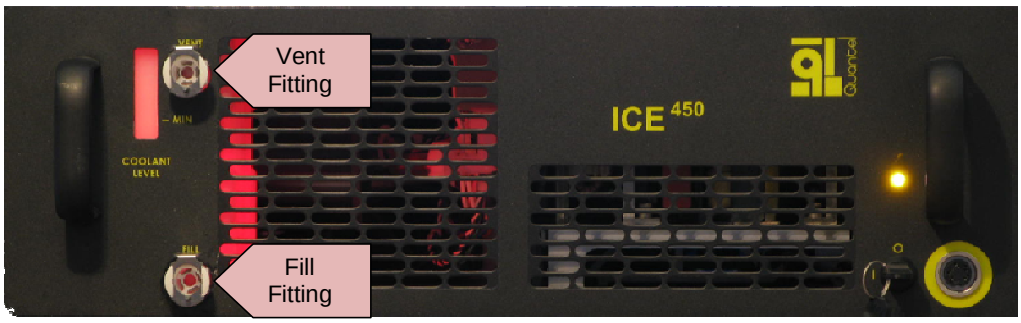


Figure 14: ICE Fill and Vent Fittings

- Keep the filling bottle above the Vent fitting height, and fill the ICE.
- When the coolant level marker indicates the ICE is filled enough, connect the Laser Head (see section 3.3), the Optical Head in the vertical position. Keep the bottle connected to the ICE, make sure there still is water in them, and turn the ICE on to power the pump. You should hear noise resulting from air bubbles flowing through the cooling system. Switch the ICE on and off as many times as needed for the pump to work continuously, waiting about 30 seconds between each switching.
- Keep an eye on the hoses, as there should not be any bubble inside.
- Place the Optical Head in a vertical position keeping the back of the head and hence the Coolant Lines above. Leave the system for about 30 seconds to allow the trapped air to collect into the reservoir.
- Add coolant to the fill bottle and repeat previous actions until the reservoir is filled, i.e. the coolant drains from the Vent fitting hose, and the air has been fully purged from the coolant loop.
- Move the bottle up and down to make bubbles coming out the cooling system.

Be sure to add coolant to the fill bottle as the Coolant Lines and Laser Head are filling up! Running reservoir dry might result in pump damaging!

The air purging, as well as a short filling in with coolant liquid, shall be done every time the Laser Head is disconnected and reconnected to the ICE system!

5.2.2. COOLING LIQUID DRAINING PROCEDURE

Drain the ICE in following steps:

- Install the fill/drain bottle into the lower Fill fitting in the front panel of the ICE and the fill/drain hose into the Vent fitting.

- Keep the fill/drain bottle below the ICE to drain the coolant reservoir. You might need to drain the bottle few times before the reservoir will empty.

Drain the Laser Head in following steps:

- Place the Laser Head in the horizontal position on the optical head supports and disconnect the coolant lines from the Laser Head.
- Tilt slightly the Laser Head to let the coolant out into a catch basin.
- Gently blow dry nitrogen through the one of the coolant connector on the Laser Head to remove remaining coolant. If you use an air dustfree aerosol, please use it with a straw, to avoid cold air in the laser cavity.
- Put the plastic caps on the Laser Head connectors.

Drain the Coolant Lines in following steps:

- Unplug both coolant hoses from the back of the ICE.
- Keeping upwards the stainless steel connectors of each coolant line press gently the white plastic part that protrudes from the end of the plastic connectors and let the coolant out of the hoses.
- Gently blow dry nitrogen to remove remaining coolant.

5.2.3. DEIONISATION CARTRIDGE REPLACEMENT PROCEDURE

Mind the coolant flow as the installation of the cartridge in the wrong direction disables its deionisation function and might result in the Laser damage!

Exchange the DESIO cartridge in following steps:

- Unplug the ICE from the main power.
- Completely drain the old coolant according to the draining procedure from all LIDAR elements - the Laser Head, the ICE reservoir and the Coolant Lines!
- Before removing of the old DESIO cartridge check its position with respect to the coolant flow direction indicated on the cartridge with the FLOW ARROW.
- Remove the old cartridge from the fitting.
- Remove the blue safety markers from the new cartridge.
- Reinstall the fitting onto the new cartridge - **Mind the FLOW direction!**
- Fill the EZ LIDAR system with coolant according to the cooling liquid filling procedure.

5.2.4. FLASH-LAMP REPLACEMENT PROCEDURE

The flash-lamp shot-counter tracking the lamp lifetime can be read out on the back panel of the ICE and reset by pressing the reset button next to the counter!

Before starting the flash-lamp replacement procedure, keep in mind the following warnings:

Never remove the flash-lamp while the coolant is still in the Laser Head as it will cause permanent Laser damage due to flooding of the Laser Cavity! Warranty would not be applicable in this case.

Keep the Optical Head in a fixed and fastened manner in strictly Laser-On-Top Horizontal Position throughout the whole flash-lamp replacement process!

The Laser Cavity Purge with Dry Nitrogen is necessary after each flash-lamp replacement!

For purging purpose use the Ultra High Purity Dry Nitrogen (O2: 2ppm, CnHm: 0.5ppm, H2O: 3ppm at 3000 hPa) under the purge pressure of 5 psi corresponding to 0.35 bar.

Before starting ensure as clean environment as possible for the exchange of the flash-lamp. Prepare the clean room with a table where you will be able to transport the Optical Head for the time of the exchange procedure!

- Disconnect the main power wait for approximately 1 minute for the full discharge of the electronics.
- Make sure the Optical Head is placed in the horizontal position on the pod.
- Detach the Laser Coolant Lines from the Optical Head and immediately cover the Laser Head coolant connectors with the provided blue protector caps.
- Unplug all electrical cables from the Optical Head.
- Protect all electrical cables and Coolant Lines with appropriate caps.
- Separate the Optical Head from the pod and transport it into the laboratory or other available clean room.
- Remove the protector caps and drain the Laser Head by tilting slightly the Optical Head and letting the coolant out into a catch basin.
- Gently blow Dry Nitrogen through one of the coolant connectors to remove remaining coolant in the Laser Head.
- Make sure the coolant is completely removed from the Laser Head before you actually exchange the flash-lamp!

Removing the flash-lamp while the coolant is still in the Laser Head will cause permanent Laser damage due to flooding of the Laser Cavity!!!

- Put on the talc-free rubber gloves for the flash-lamp exchange.

- Remove the flash-lamp access cover from the Laser Head by rotating it counter-clockwise.
- Removal of the cover will reveal the black plastic lamp insertion tool.
- Firmly pull the insertion tool outward, straight and evenly to avoid breaking the flash-lamp glass tube!

Use talc-free rubber finger cots throughout the whole flash-lamp exchange process! Handle the new flash-lamp only with finger cots! Do not touch the flash-lamp glass tube at any time and hold it by the metal holding part only!

- Clean the new lamp with methanol or acetone, using optical paper.

Be sure the wet optical paper only touches the glass part of the lamp, and avoids the metallic parts.

- Slightly dampen the lamp with distilled water, in order to make its sliding easier inside the Laser Head (touching freshly worn finger cot in a single drop of water and wetting the lamp envelope will do).
- Slowly and carefully slide the lamp horizontally into the Laser Head.
- The lamp must come up against the back of the cavity, and could not be pushed anymore.
- The lamp will bottom solidly when it is completely installed.
- If you are unsure whether the lamp is properly settled, pull it back of about 2 cm (1 inch) and reseat it.

Make sure that the flash-lamp is fully seated in the Laser Head as wrong placement of the lamp will cause Laser damage!

- Make sure the seal is properly seated into the lamp access cover.
- Replace the cover by pushing and rotating it clockwise.

To prevent condensation on the optical elements within the Laser Cavity, dry nitrogen has to be purged through the Laser Head!

Make sure that the level of purity of the dry nitrogen used for the Laser purge after the flash-lamp exchange meets following specifications: Ultra High Purity Dry Nitrogen, O2: 2ppm, CnHm: 0.5ppm, H2O: 3ppm at 3000hPa. The purge pressure must be 5psi (0.35 bar).

- Remove the purge plugs at the back of the Optical Head. Keep the screws in a secure place as you will need it for reinstallation!
- Screw the valve (Accessory Kit) onto one of the purge hole and connect it to the Ultra High Purity dry Nitrogen source.
- Flow 5 psi (0.35 bars) dry nitrogen through the Laser Head for 10 min.
- Replace the screw in the exit purge hole while the dry nitrogen is still blowing into the system.
- Remove the valve and quickly reinstall the entry-purge screw in this remaining hole.

6. CUSTOMER SERVICES AND WARRANTY

6.1. HOTLINE

The EZ LIDAR users have access to a free Hotline* in the case when any assistance is required, regarding the system's operations or maintenance.

Technical support can be provided by qualified software, optoelectronics and Lidar engineers:**

- **Over the Hotline Phone Number + 33 1 69 35 88 23 / + 33 6 84 06 87 67 *****
- **Or through support@leosphere.fr**
- **From Monday to Friday between 10am to 5pm (GMT+1)**

* free Hotline of 5 hour credit

** in certain countries a local first-level support is available and provided during the LEOSPHERE Training

*** if the phone number was to change a new one will be immediately communicated to the EZ LIDAR users

6.2. WARRANTY

Unless provided otherwise, the LEOSPHERE's products (instruments and software) are warranted for 1 year (components and labor) from the date of delivery and are applicable only to delivered materials.

No goods shall be returned without LEOSPHERE's prior written agreement! If the user invokes the warranty, LEOSPHERE shall determine intervention method!

- Return of goods is applicable only to goods that have not been modified or altered in any manner and must be done in original packaging.
- The warranty does not cover non-capital goods, including flash-lamps and joint seals, which replacement is included in the light maintenance program, the cost of which is supported by the owner.
- The warranty does not cover replacement and/or repairs resulting from either outwear, ageing or tear of the instrument components, instrument deterioration, demolitions and accidents resulting from negligence or disregard of the operating instructions

enclosed in this document, from lack of supervision, maintenance or stocking, or from manipulation or use not conforming to LEOSPHERE or manufacturer's specifications.

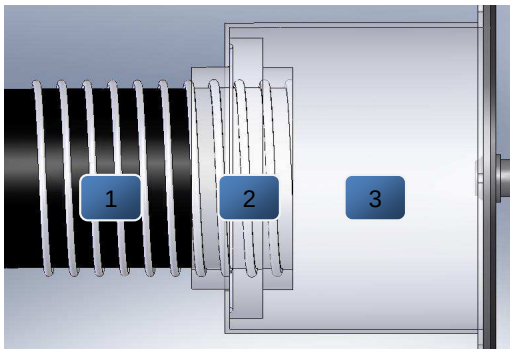
- The warranty does not convey the right to download new system software versions but the right to the replacement of identical system software as acquired by owner at a time of purchase.
- The warranty does not constitute a maintenance contract which must be the object of a separate contract.

7. ANNEXES

7.1. HYPALON SLEEVE MOUNTING

The Hypalon Sleeve allows an excellent protection of both the connectors, and the cables on the Optical Head, and/or the Casing. It is made of 3 or 5 parts, depending whether your system comprises a Casing or not:

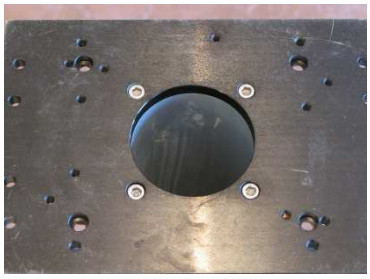
1. The Hypalon Sleeve in itself,
2. 1 or 2 Interfaces,
3. And 1 or 2 Connectors Protection.

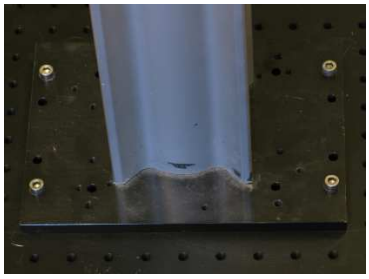


The Hypalon Sleeve could be assembled following these instructions:

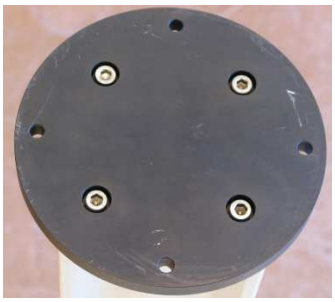
- Fix the Interface in the Connectors Protection.
- Screw the Sleeve in the Interface
- Slip the cables into the Sleeve
- Screw the Connectors Protection on the Optical Head/Casing.

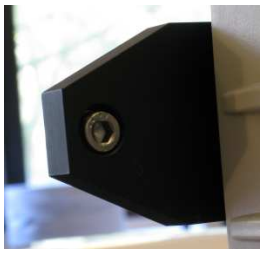
7.2. SCANNING DEVICE MOUNTING





- First, set the large baseplate up on the floor.
- Fasten the adaptation plate to the profile with 4 M6x20 screws, and then to the large baseplate with 4 M6x16 screws
- Use 4 M6x20 screws to tighten the disk-shaped plate to the other end of the profile.
- Then, fasten the scanning device with the slide plate, using 4 M6x12 screws, and then fasten it to the disk-plate with the 4 hexagonal-headed screws.



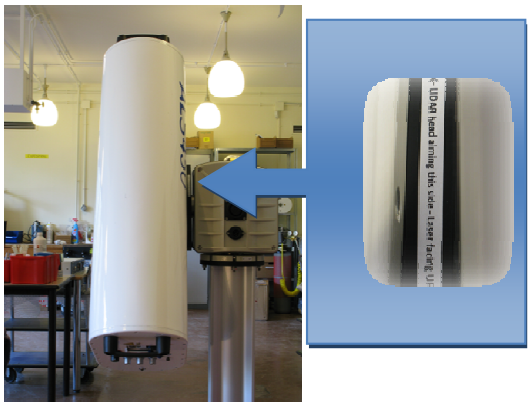


The following step involves at least two people!

- Insert 2 M6x8 screws into the slide plate.
- While the first person is carrying the optical head, the second one is carefully fastening these two screws into it.

Keep in mind that the optical head pointed as needs to be sticker on the indicated by the slide plate.

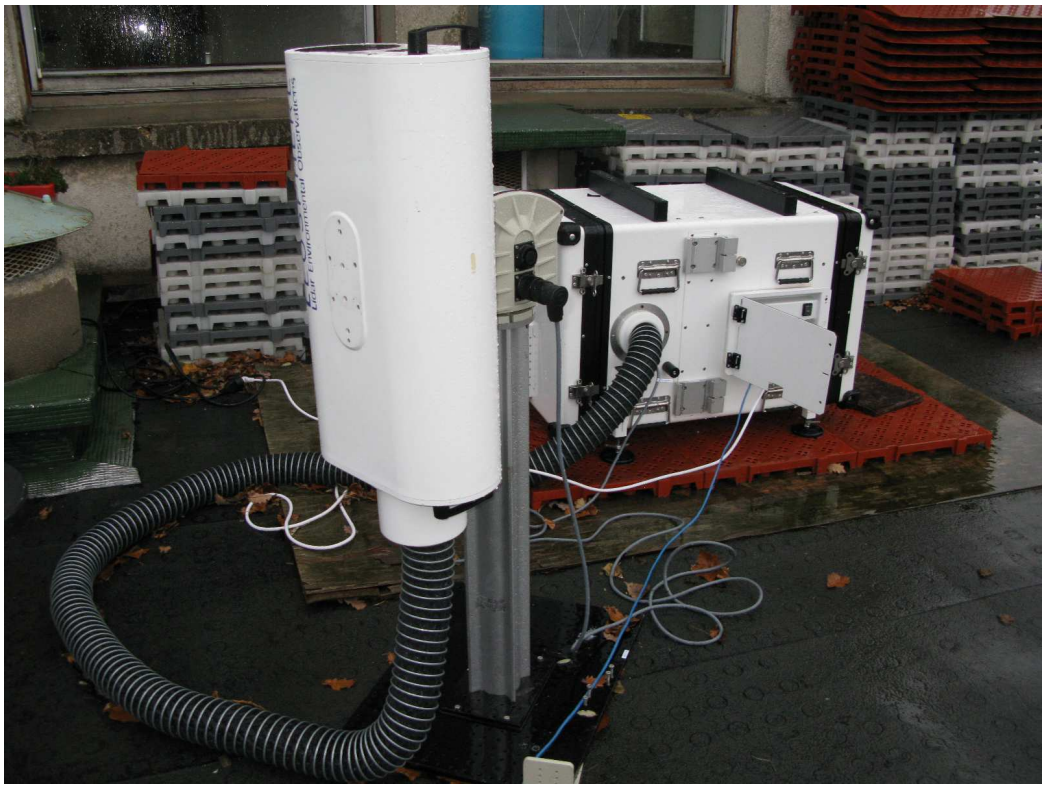
- Gently shake the optical head to make sure it is well tightened to the scanning device.



Any looseness should not be tolerated!

7.3. DIFFERENT CONFIGURATION FOR THE MOUNTING OF THE LIDAR WITH A CASING

7.3.1. CASING AND LIDAR SEPARATED



- Assemble and connect the lidar to the casing as notified in the procedure.
- Mount the lidar on the scanning device as précised in the 7.2 section

7.3.2. LIDAR FIXED ON THE SIDE OF THE CASING

This configuration is not available with a scanning device

- Fixe the profile on the side of the casing using the 2 mounts (use a 5mm hex key).
- Connect the lidar to the casing as notified in the procedure
- Fixe the lidar on the top of the profile, as you can see on the picture above

7.3.3. LIDAR ON THE TOP OF THE CASING

- Assemble and connect the lidar to the casing as notified in the procedure.
- Fixe the baseplate on the top of the casing using 2 M6 screws
- Fixe the profile on the baseplate
- Fixe the scanning device on the profile as specified in the 7.2 section
- Mount the lidar on the scanning device as précised in the 7.2 section

7.4. REMOTE CONTROL OF ALS

Pre-requirement

- Laptop with WINDOWS XP (preferable) and standard network board
- Crossed ethernet cable
- IP Adress of the ALS's PC

Procedure

- Configure laptop IP address to be compatible with ALS internal PC :
  - IP: **129.175.131.XX (2-30)**
  - Subnet Mask: **255.255.255.224**
  - Gateway: **129.175.131.1**

Two last digits has to a number between 2 and 30 and different from the system IP address

NOTE: To change a computer IP address:
- Select: **Start↵ Settings↵ Network connexions↵**
- Double click on **Local area connexion**, then **Properties**
- Choose **Internet Protocol (TCP/IP)**, then **Properties**
- Modify IP

Please make sure that WiFi switch is off on laptop as WiFi connexion attempts might perturb remote connexion to ALS

- Switch ALS on using the system main switch
- Connect laptop to ALS via Ethernet crossed cable using the system **Ethernet connector number 2 (if no casing)** or **Ethernet Connector RJ45 (if casing)**

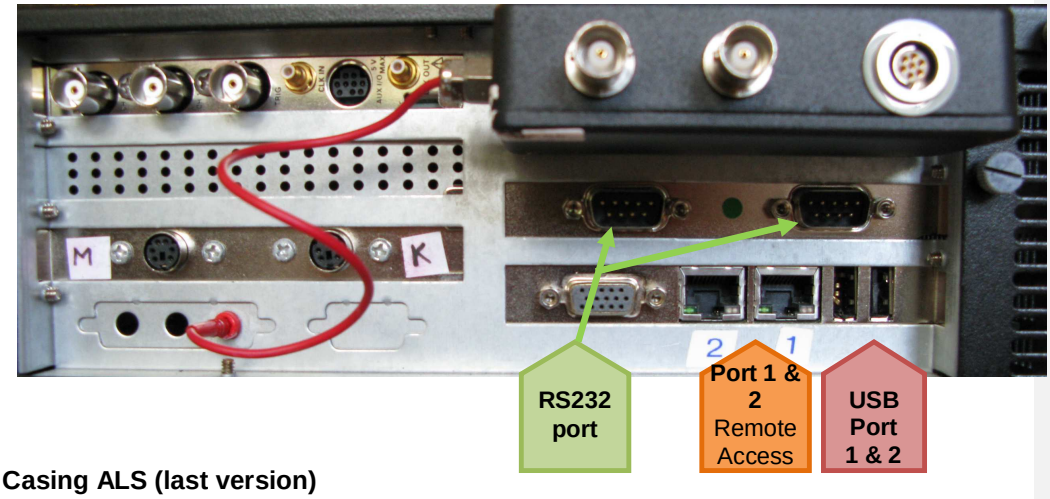
Mis en forme : Police :Non Gras

Mis en forme : Sans numérotation ni puces

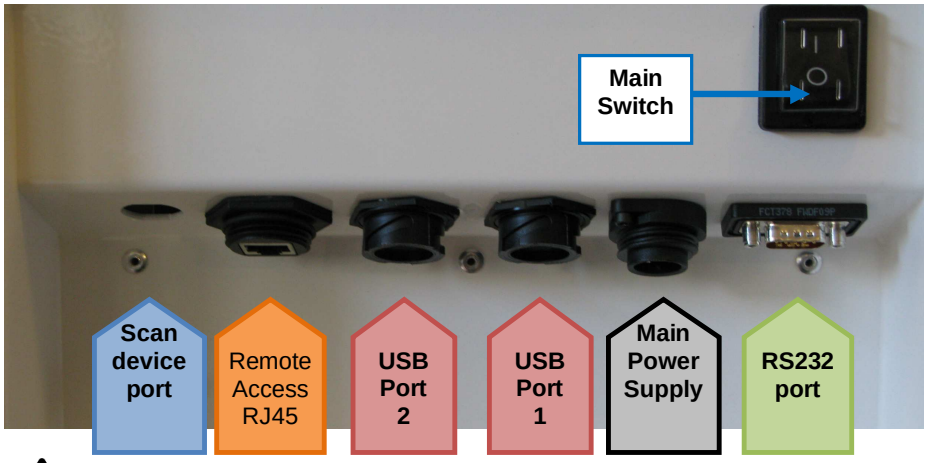
Mis en forme : Police :Gras, Non souligné, Couleur de police : Automatique

Mis en forme : Sans numérotation ni puces

PC ALS(if no casing)



Casing ALS (last version)



- **Please note that most of standard network board operates with crossed or non crossed cables. However, if laptop is not recent enough, the user should use a crossed cable**

- Use Windows **remote desktop connexion** software for example accessible via **All program↵ Accessories↵ Communication↵ Remote Desktop Connexion**

- ALS450/300 IP address is **129.175.131.YY:1266** **(see user documents for the YY)**
- Use **user** as login and **operator** as password.

Mis en forme : Sans numérotation ni puces