

# ALC-601

Version 1.1 revised 19 Mar 2015



## User Guide

(covering single and multi-port models)

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## Revision History

Version	Released	Description
1.0	01 Oct 2012	Initial Release
1.1	19 Mar 2015	Updated presentation (All Sections) Expanded laser safety information.

## Safety and Warning Information



### PLEASE READ THIS INFORMATION FIRST

1. If the equipment is used in a manner not specified by Andor, the protection provided by the equipment may be impaired.
2. See Section **6.1 Emergency Disconnection**.
3. Before using the system, please follow and adhere to all warnings, safety, manual handling and operating instructions located either on the product or in this User Guide.
4. The product is only to be used as part of a Revolution WD or XD Microscope System. Users must be authorised and trained personnel only; otherwise this may result in personal injury, and/ or equipment damage and impaired system performance.
5. To ensure correct and safe operation of this product, please read this manual before use. Keep this user guide in a safe place for future reference.
6. This product contains lasers within the wavelength range 405nm to 660nm.
7. IEC Technical Document IEC TR 60825-14 recommends the presence of a Laser Safety Officer (LSO), however national guidelines should be referred to.
8. There are no user-serviceable parts inside the product and the enclosure must not be opened. Only authorised Andor service personnel may service this equipment.
9. This product is powered by the mains and includes mains components. If you open the enclosure, you expose yourself to electric shock hazards.
10. Protective earth is an integral part of the protection against electric shock in this product. Do not tamper with any of the earthing measures.
11. Only the correctly specified mains power supply and fuse should be used.
12. Use only the power supply cord provided with the product for this unit. Should this not be correct for your geographical area contact your local Andor representative.
13. Make sure the electrical cord is located so that it will not be subject to damage.
14. Do not position this product so that it is difficult to operate the disconnecting device. The disconnecting device is the mains lead. This will either be the mains lead connected to the product, or in the case of a cabinet-based system the mains lead to the cabinet.
15. A number of screws on the product may have been marked with red paint to prevent tampering. If you adjust these screws your warranty will be void.
16. Whilst running an experiment try to keep room temperature as stable as possible.
17. This equipment has not been designed and manufactured for the medical diagnosis of patients.
18. Electromagnetic Compatibility: This is a Class A product. In a domestic environment this product may cause electromagnetic interference, in which case the user may be required to take adequate measures.
19. Due to the sensitive nature of this equipment, it should be used in an EM-controlled environment, i.e. one where there are no strong electromagnetic (EM) sources, e.g. a typical life science test laboratory. If noise patterning or optical fluctuations are seen, contact Andor Customer Support for advice.

20. The product contains components that are extremely sensitive to static electricity and radiated electromagnetic fields, and therefore should not be stored close to EMI/RFI generators, electrostatic field generators, electromagnetic or radioactive devices, or other similar sources of high energy fields.
21. Performance of the product may be compromised if operated close to sources of high energy fields identified in 20 or in close proximity to plasma sources, arc welders, x-ray instruments and intense pulsed sources e.g. lasers, xenon strobes, arc lamps and the like.
22. Your product is a precision scientific instrument containing fragile components. Always handle it with care.
23. Do not wet or spill liquids on the product. Do not store or place liquids on the Cabinet worktop.
24. If spillage occurs on the product, switch off power immediately, and wipe off with dry, lint-free cloth.
25. If any ingress has occurred or is suspected, unplug mains cable, do not use, and contact Andor Customer Support.
26. For information on cleaning and decontamination please refer to **Section 7.1**
27. For ventilation requirements please refer to **Section 5.1.2**
28. See section on **Manual Handling**.
29. Do not expose the product to extreme hot or cold temperatures.
30. Do not expose the product to open flames.
31. Do not allow objects to fall on the product.

## GENERAL SAFETY LABELS

The following are explanations of the safety symbols found on this product:



Caution, risk of electric shock.



Caution, risk of danger.



Caution, risk of laser radiation hazard



Caution, consult technical manual before servicing.



Heavy object



Mandatory 2-man lift



Do Not Lift (ALC-601 with MPU only)



This product has been tested to the requirements of CAN/CSA-C22.2 No. 61010-1, second edition, including Amendment 1, or a later version of the same standard incorporating the same level of testing requirements.

## LASER SAFETY

**CAUTION - USE OF CONTROLS OR ADJUSTMENTS OR PERFORMANCE OF PROCEDURES OTHER THAN THOSE SPECIFIED HEREIN MAY RESULT IN HAZARDOUS RADIATION EXPOSURE**

This product may contain lasers that cover the entire visible spectrum and extend into the invisible infra-red spectrum. This section of the manual is designed to make the end-user aware of the hazards of the product due to these lasers. Laser safety hazards differ from those of normal light sources and users must be familiar with the hazardous properties of lasers as these are highly-concentrated, low divergence beams of radiation.

Andor recommend that all facilities have an established system for the safe use of lasers as per their national frameworks and Occupational Health and Safety legislation. Laser Safety standards IEC 60285-1 and American National Standard Z136.1-2007 - Safe use of Lasers may be useful references for good practice.



## LASER SAFETY AND PRODUCT COMPLIANCE LABELS

All relevant safety compliance information is visibly displayed on the ALC-601 as per the International Laser Safety Standard IEC 60825-1 and the U.S. Laser Product Performance Standard 21 CFR 1040.10.

As the ALC-601 will form part of a unique configuration of components it cannot be classified in isolation. Therefore when integrated, it may form part of a system with one of the classifications described below. A label in the format depicted below will be included for application by the System Integrator following assessment and classification. The ALC-601 may be configured as part of a larger system that includes multiple Class 3B and Class 4 lasers. A number of separate emission wavelengths can also be available in any one system. In some very rare occasions another classification label may be used, this will be explained in additional documentation as appropriate.

### Class 1



Laser products that are safe during use, including long-term direct intrabeam viewing, even when exposure occurs while using optical viewing instruments (eye loupes or binoculars).

Class 1 also includes high power lasers that are fully enclosed so that no potentially hazardous radiation is accessible during use (embedded laser product). Intrabeam viewing of Class 1 laser products which emit visible radiant energy may still produce dazzling visual effects, particularly in low ambient light.

### Class 3B



Laser products that are normally hazardous when intrabeam ocular exposure occurs (i.e. within the NOHD) including accidental short time exposure. Viewing diffuse reflections is normally safe. Class 3B lasers which approach the AEL for Class 3B may produce minor skin injuries or even pose a risk of igniting flammable materials. However, this is only likely if it is a small focused spot.

Note: There exist some theoretical (but rare) viewing conditions where viewing a diffuse reflection could exceed the MPE. For example for Class 3B lasers having powers approaching the AEL, lengthy viewing of greater than 10 s of true diffuse reflections of visible radiation and viewing at distances less than 13 cm between the diffusing surface and the cornea can exceed the MPE.

### Class 4



Laser products for which intrabeam viewing and skin exposure is hazardous and were viewing of diffuse reflections may be hazardous. These lasers also often represent a fire hazard.

## LASER APERTURE

Laser Aperture warning labels indicate that during installation laser radiation may be emitted from the optical fibres when disconnected. When properly installed, no laser radiation will be emitted from these points during use.



Figure 1: Example of Laser aperture warning label

The System Integrator **MUST** ensure that the final system's Laser Aperture is suitably labelled e.g. the microscope's Objective is identified by a label on the microscope's stage top. An example is shown below.

The appropriate aperture label is included with the documentation for application by the System Integrator.



Figure 2: Example of Laser emission warning label on microscope

## DESCRIPTION OF EMITTED RADIATION FROM THE LASER PRODUCT

Parameter	Values	Notes
Wavelengths	400-660nm	Exact outputs will depend on the integrated laser source, please refer to it's Explanatory Label and User Documentation
Beam Divergence	0.3-1.4 NA	Exact divergence will be dependent on the objective in use, please refer to the microscope's User Documentation
Maximum Power or Energy Output	<500 mW	The maximum output power will depend on the integrated laser source and the configured optical elements but will be significantly less than 500mW
Pulse Duration	N/A	All recommended laser sources for the Borealis Product are Continuous Wave output
Pulse Repetition Rate	N/A	All recommended laser sources for the Borealis Product are Continuous Wave output
Irregular Pulse Pattern	N/A	All recommended laser sources for the Borealis Product are Continuous Wave output

## DESCRIPTION OF EMITTED RADIATION FROM THE INTEGRATED LASER SOURCE

This is dependent on the laser source(s) integrated within the ALC-601. As there are multiple options available from Andor please refer to the Laser Source's Explanatory Label and User Documentation for a description of its Emitted Radiation.

## RECOMMENDED RESPONSIBILITIES OF A LASER SAFETY OFFICER

These include, but are not restricted to, the following; however, national guidelines should also be referred to:

1. Ensuring all personnel requiring access to the product are fully trained in both using the product and the general use of Class 3B and Class 4 lasers (see below).
2. Ensure users are familiar with the hazardous properties of lasers; namely that laser safety hazards differ from those of normal light/radiation sources as they are high-intensity, highly collimated beams of electromagnetic radiation.
3. Ensuring the equipment is used in a controlled area by trained end users in accordance with national guidelines.
4. Ensuring end-users are familiar with the operation of the laser's key switch control, interlocks, emission LEDs and other safety features.
5. Ensuring that all interlocks are connected and functioning correctly.
6. We recommend that a copy of IEC 60285-1 is purchased by the laser safety officer for reference.

## GUIDELINES FOR SAFE OPERATION OF LASER PRODUCTS

1. Read the safety instructions supplied with all equipment in the system.
2. Never look into a laser beam either directly or indirectly.
3. Do not attempt to disassemble the unit housing the lasers or any part of the system. If there is a problem please contact Andor directly (see SECTION 1.1, "Help and Technical Support").
4. Restrict and control access to the area(s) where laser(s) are in use to those persons who are trained in the dangers of lasers and trained on the safety precautions to be observed when working with lasers.
5. Ensure suitable laser warning signs are prominently displayed in the area the system operates.
6. If the system is not in use turn the laser off using the key switch.
7. On a daily basis, or before every use, verify that the laser interlock circuit is working by confirming that the laser emission indicator on the source turns off when any of the following are done:
  - The microscope binocular eyepieces are in the open position.
  - The articulated transmitted light arm on inverted microscopes is tilted back from the functional vertical position before using the system.
8. Fluorescent cards should be used to visually locate and indicate the output of invisible wavelengths at all times
9. Additional precautions may need to be implemented as the necessary precautions will be specific to each system's installed configuration and typical mode of use. The responsible Laser Safety Officer must assess and implement the necessary precautions to avoid possible exposure to hazardous radiation during use.

## CLASSIFICATION OF AN INSTALLED SYSTEM

The proposed installation scheme of all systems is captured and assessed for all orders received by Andor. To breach the Class 4 limits for accessible emissions, due to known standard attenuations, the input laser power would have to be in excess of 5W. We know this configuration is not possible at present and can therefore safely classify the majority of systems at Factory QC as Class 3B products.

The only case to re-assess the accessible emissions if is the beam path appears to be fully enclosed. The following test criteria should be applied if a system is felt to be fully enclosed e.g. uses a stage cover and / or environmental enclosure.

Assess if any of the laser emissions are open to Human Access as defined by:

1. ability of the human body to meet laser radiation emitted by the laser product, i.e. radiation that can be intercepted outside of the protective housing, or
2. ability of a cylindrical probe with a diameter of 100 mm and a length of 100 mm to intercept levels of radiation of Class 3B and below, or
3. ability of a human hand or arm to intercept levels of radiation above the AEL of Class 3B,

- also, for levels of radiation within the protective housing that are equivalent to Class 3B or Class 4, ability of any part of the human body to meet hazardous laser radiation that can be reflected directly by any single introduced flat surface from the interior of the product through any opening in its protective housing.

The standard Ophir PD-300W sensor and power meter can be used to assess accessible power levels in conjunction with suitable Safety Glasses and applicable Safe Systems of Work. Any queries should be referred to the Andor Product Laser Safety Officer for guidance.

If Human Access is not possible then the device should be reclassified as a Class 1 device. This involves the following steps:

- Remove all other Explanatory (Classification) Labels EXCEPT those on the Laser Sources (these count as Removable Laser Sources and need to remain labelled and classified as stand-alone products).
- Fit a Class 1 Explanatory Label onto a permanently affixed surface which is easily visible before and during operation of the system.
- Ensure a Laser Hazard Symbol is clearly visible before and during operation and affix a label if not.

## EYE PROTECTION

Eye Protection is not required for the safe use of the device as the only radiation observable (without intentional misuse) is directionally stable, diffuse and highly divergent from the designated aperture which is static and labelled. Eye protection must be used by all Installation and service personnel when accessing any radiation during any installation or service procedure.

If eye protection is deemed desirable by the local Laser Safety Officer, Andor recommends the following products:

- 360 nm – 510 nm – Kentek KXP-4001 Spectacles
- 510 nm – 670 nm – Kentek KRA 6702 Spectacles

## WORKING WITH OPTICAL FIBRES

- Only service personnel authorized by Andor should remove or inspect fibres.
- The laser radiation passing through fibres is potentially hazardous, so great care should be taken to avoid damage that may lead to exposure to this hazardous radiation.
- The fibre can be easily damaged by bending or general mishandling. Ensure that the minimum curvature is never exceeded when handling. Recommended minimum bend radius is 30 mm.
- Optical fibres are prone to damage by bending local to the connector.
- The coupler is not designed to withstand pulling of the fibre. If the fibre is pulled the system performance could be compromised or the system may fail.

## MANUAL HANDLING

Manual handling of the ALC-601 should only be carried out by Andor Customer Support Personnel.

Due to the delicate nature of some of the components within, care must be exercised when handling this product.

Proper manual handling techniques are important when installing the Revolution XD system to ensure that the integrity of the product is safeguarded and individuals involved are not exposed to unnecessary manual handling risks, such as:

- Lifting a load which is too heavy
- Poor posture or technique during lifting
- Dropping a load
- Lifting objects with sharp edges



Special attention should be drawn to the ALC and the housing cabinet, the weights of which exceed guidelines for safe lifting by a single person. Both items have been suitably marked/ labelled with the above sign to indicate this specific hazard.

## SECTION 1: INTRODUCTION

Thank you for purchasing an Andor Laser Combiner (ALC) and optional Multi Port Unit (MPU). You are now in possession of a unique laser distribution unit, designed for the most challenging microscopy applications.

This manual contains useful information and advice to ensure you get the optimum performance from your system. If you have any questions regarding your ALC or MPU please feel free to contact Andor directly, or via your local representative or supplier.

The ALC and MPU are designed to be used in research laboratories and other controlled scientific environments.

This manual is aimed at covering the operation and maintenance of both the standard ALC-601 and ALC601 with MPU, which along with the ILE laser combiner series provide the primary laser excitation sources at the heart of the Revolution WD or XD system.

These products form part of the Revolution XD system, and so to use any other equipment with this product, please read the manuals for the other system components also. Some of the equipment described in this manual may not be included in the set you have purchased.



Figure 3: Revolution XD Confocal Microscopy System Components

### 1.1 TECHNICAL SUPPORT

If you have any questions regarding the use of this equipment, please contact the representative\* from whom your system was purchased, or:

#### Europe

Andor Technology  
7 Millennium Way  
Springvale Business Park  
Belfast  
BT12 7AL  
Northern Ireland  
Tel. +44 (0) 28 9023 7126  
Fax. +44 (0) 28 9031 0792

[www.andor.com/contact\\_us/support\\_request](http://www.andor.com/contact_us/support_request)

#### USA

Andor Technology  
425 Sullivan Avenue  
Suite # 3  
South Windsor  
CT 06074  
USA  
Tel. +1 (860) 290-9211  
Fax. +1 (860) 290-9566

[www.andor.com/contact\\_us/support\\_request](http://www.andor.com/contact_us/support_request)

#### Asia-Pacific

Andor Technology (Japan)  
4F NE Sarugakucho Building  
2-7-6 Sarugaku-Cho  
Chiyoda-Ku  
Tokyo 101-0064  
Japan  
Tel. +81-3-3518 6488  
Fax. +81-3-3518 6489

[www.andor.com/contact\\_us/support\\_request](http://www.andor.com/contact_us/support_request)

#### China

Andor Technology  
Room 1213, Building B  
Luo Ke Time Square  
No. 103 Huizhongli  
Chaoyang District  
Beijing, 100101 P.R.  
China  
Tel: +86 (0)10 51294977  
Fax. +86(0)10-6445-5401

[www.andor.com/contact\\_us/support\\_request](http://www.andor.com/contact_us/support_request)

\* The latest contact details for your local representative can be found on our website.

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Changes are periodically made to the product and these will be incorporated into new editions of the manual. New versions of all Andor manuals will be made available through MyAndor <http://my.andor.com/login.aspx>. If you do not have an account please register at <http://my.andor.com/Register.aspx>.

## SECTION 2: SPECIFICATIONS

### 2.1 MECHANICAL DRAWINGS

#### 2.1.1 STANDARD ALC-601

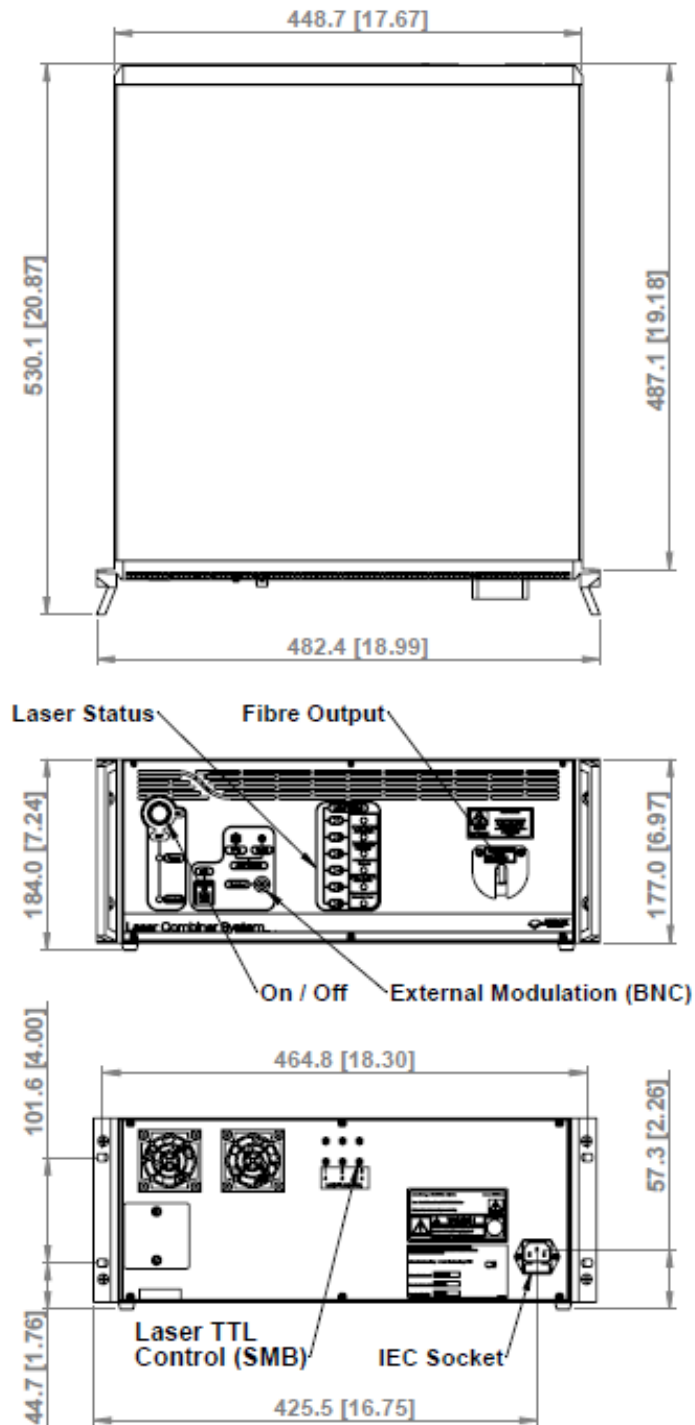


Figure 4: Standard ALC-601 Dimensions



### 2.1.2 ALC-601 WITH MPU

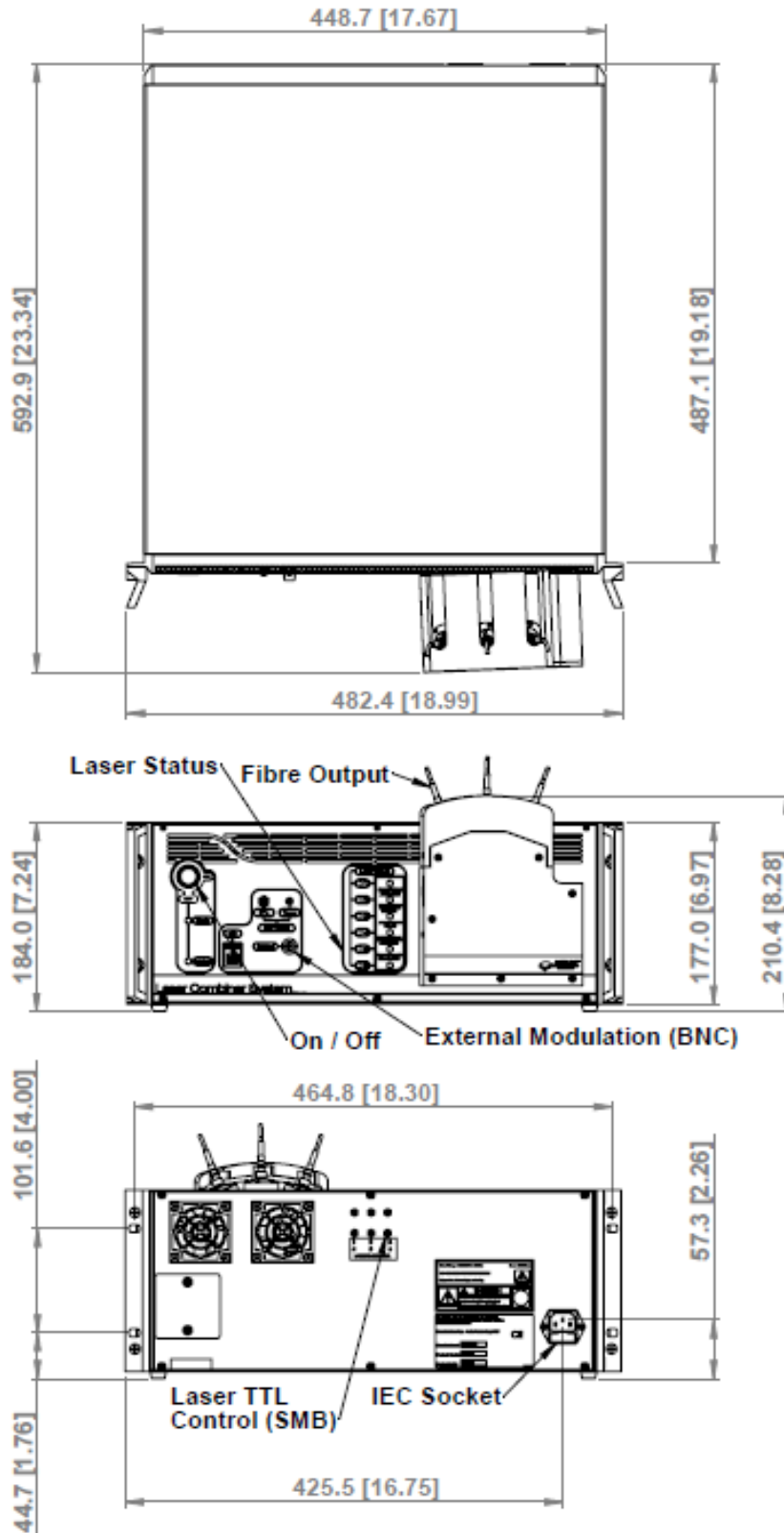


Figure 5: ALC-601 with MPU Dimensions

## 2.2 POWER SUPPLY

This product must be powered via the rear 3-pin IEC C14 connector from an a.c. mains power supply with the following ratings:

Parameter	Specification
Voltage Range	100 - 240 V AC.
Frequency Range	50 - 60 Hz
Power Rating (absolute maximum)	350 W
Overvoltage Category	CAT II*

\* Note that this is a technical term to say that the product will expect to be plugged into a typical mains socket and experience the typical transient voltages that appear there.

## 2.3 OPERATING CONDITIONS

The product has been designed for the following operating conditions:

Parameter	Specification
Location	Indoor use
Operating Temperature	23°C ± 5°C
Storage Temperature	0°C to 50°C
Operating Relative Humidity	70% (non-condensing)
Altitude	Up to 2000 m
Pollution Degree	2*

\* Note that this is a technical term to say that normally only non-conductive pollution occurs; occasionally, however, a temporary conductivity caused by condensation must be expected.

- This product has not been designed to operate correctly in direct sunlight, so it should be avoided.
- The term “indoor use” also implies that it is not designed to expect water spills.
- Whilst running an experiment try to keep room temperature as stable as possible.

## 2.4 ELECTRICAL INTERFACE SPECIFICATIONS

This section is focused on the electrical specifications of the interfaces, rather than their operation. Information on operation may be found in **Section 6 Operation**. The following figures show the front and rear panels of the product with the connectors referred to in this section.

### 2.4.1 STANDARD ALC-601 INTERFACE

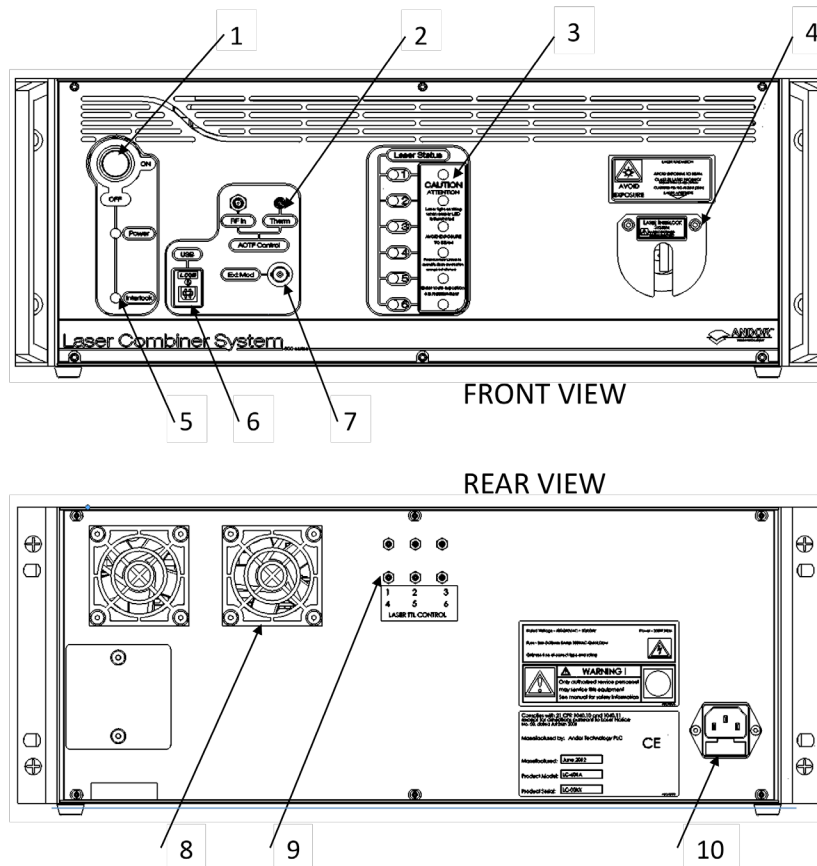


Figure 6: Standard ALC-601 Interfaces

- Key:**
- |                                      |  |
|--------------------------------------|--|
| 1. Key Power Switch and Power-on LED | 2. AOTF Control (RF In and Therm)                          |
| 3. Laser Status LED Panel            | 4. Optical Fibre Output Port with Interlocked Fibre Shroud |
| 5. Interlock LED                     | 6. USB Port  |
| 7. External Modulation               | 8. Fan Exhaust Vents                                       |
| 9. TTL Laser Control                 | 10. AC Mains   |

### 2.4.2 ALC-601 WITH MPU INTERFACE

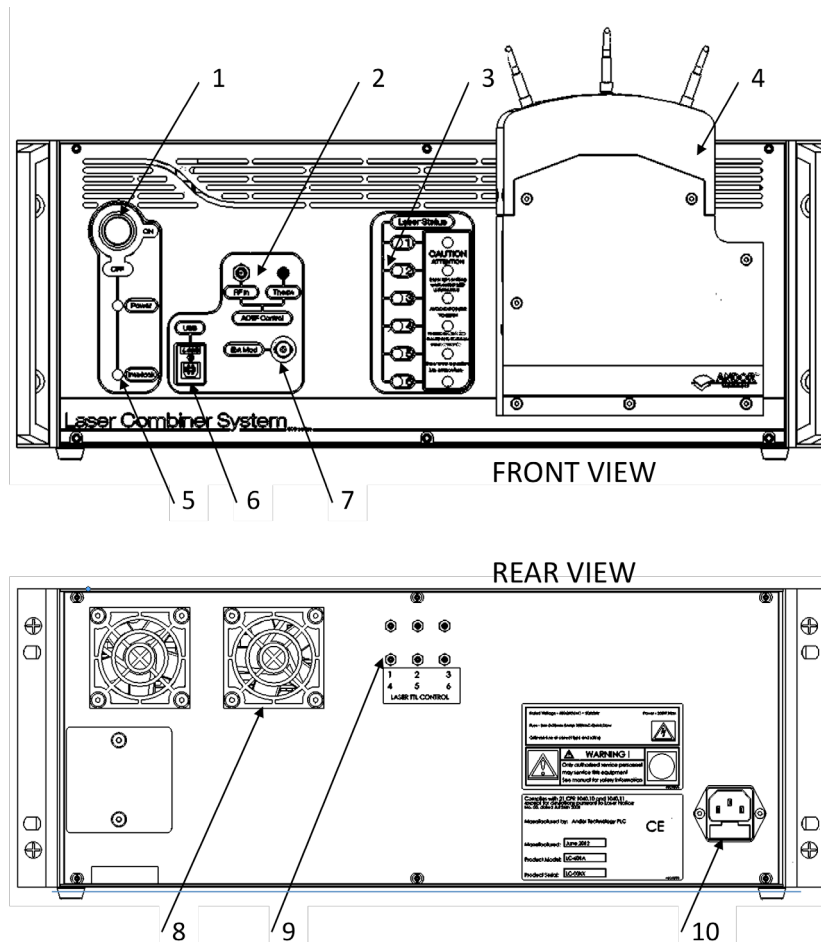


Figure 7: ALC-601 with MPU Interfaces

- Key:**
- |                                      |   |
|--------------------------------------|---|
| 1. Key Power Switch and Power-on LED | 2. AOTF Control (RF In and Therm)                             |
| 3. Laser Status LED Panel            | 4. Optical Fibre Output Port(s) with Interlocked Fibre Shroud |
| 5. Interlock LED                     | 6. USB Port   |
| 7. External Modulation               | 8. Fan Exhaust Vents  |
| 9. TTL Laser Control                 | 10. AC Mains  |

### 2.4.3 USB

This interface is used for software control of the ALC:

**Connector Type:** USB Series B Receptacle

**Signal Type:** Bi-directional USB

### 2.4.4 AOTF CONTROL

This interface is used for control of the AOTF (Acousto-Optical Tuneable Filter) in the ALC via the PCU.

#### **RF In**

**Connector Type:** SMA Female

**Signal Type:** RF input

**Electrical Specification:** This is a dedicated connection to the “RF Out” connector of the PCU and is not designed for other uses.

#### **Therm**

**Connector Type:** SMC Male

**Signal Type:** Power

**Electrical Specification:** This is a dedicated connection to the “Therm” output of the PCU and is no designed for other uses.

### 2.4.5 EXT MOD

This interface is used for the external control of up to four Coherent Cube lasers for FLIM applications.

**Connector Type:** BNC Female (50 ohm size)

### 2.4.6 TTL LASER CONTROL

This interface is used for the external control of up to 6 diode lasers.

**Connector Type:** SMB Jack (50 ohm size)

## 2.5 OPTICAL SPECIFICATIONS

Parameter	Specification
Wavelength Range	400 – 660 nm
Power at Output Port	< 500 mW Class 3B*
Output Port	Free-space transmission through FC connector
Optical Fibre	Single-Mode, polarisation-maintaining armoured fibre assembly. FC/APC on ALC-side to stop feedback from back-reflections into the laser. Various output angle and orientation options on output to other equipment.
Fibre Numerical Aperture	0.11
Polarisation	Parallel to fibre o/p connector keyway
AOTF cross-talk	Better than -26 dB
Fibre coupled power stability (typical)	< 1 %/°C (diode-pumped solid-state lasers) < 3 %/°C (direct diode lasers)

\* Output power will vary depending on lasers in system and which ones are switched on at any one time.

## 2.6 MECHANICAL SPECIFICATIONS

Parameter	Specification
Enclosure Type	19" Sub-rack BS EN 60297 Aluminium Construction
Width	483 mm
Height (with MPU Head)	184 mm (210mm)
Depth (with MPU Head)	530 mm* (593mm*)
Weight (with MPU Head)	38 kg max. (42kg max) [with 6 lasers]
Finish	Painted: Housing, Front Panel
Ingress Protection	IP20†

\* Excluding connected cables front and rear, but including handles.

† Protection against fingers or other object not greater than 80 mm in length and 12 mm in diameter. Not protected from harmful entry of various forms of moisture (e.g. dripping, spraying, submersion, etc.)

## 2.7 TRANSPORT & STORAGE SPECIFICATIONS

- The packaging used for the original delivery should be retained for further use.
- This product must be shipped in accordance with the international standard ETS 300119 Class 2.1.
- System functional performance shall be maintained following exposure to a Storage/Transportation temperature range of 0°C to 50°C
- The crate must be protected from excesses of weather.
- Shipping crate(s) must be wheeled, wooden and conform to ISPM15 regulations.
- Relative humidity must not exceed 90% (non-condensing).

Parameter	Specification
Shipped Dimension (with MPU)	1040 × 790 × 790 mm (40.94 × 31.10 × 31.10 inches)
Shipped Dimension (without MPU)	910 × 790 × 790 mm (35.83 × 31.10 × 31.10 inches)
Approximate Shipped Weight	89 kg (196 lb) depends on number/ type of lasers deployed

Please note that the product's cardboard box will be packed along with other boxes inside a larger wooden crate.

### SECTION 3: MPU CONTROLLER SPECIFICATIONS

#### 3.1 MECHANICAL DRAWINGS

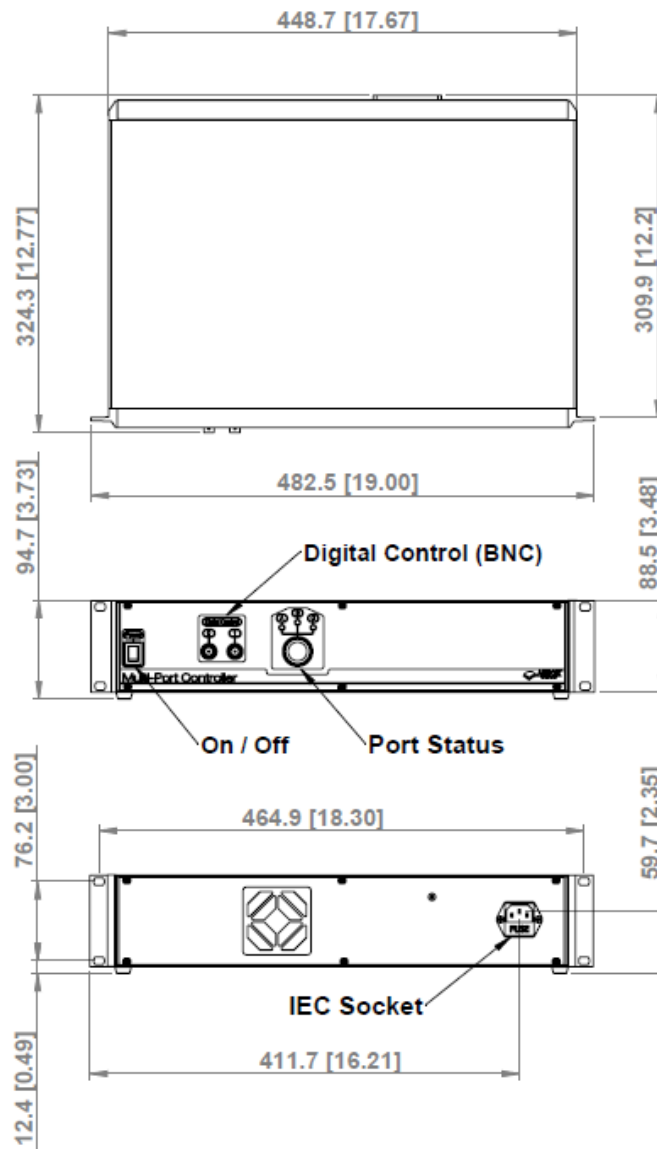


Figure 8: MPU Controller Dimensions

### 3.2 POWER SUPPLY

This product must be powered via the rear 3-pin IEC C14 connector from an a.c. mains power supply with the following ratings:

Parameter	Specification
Voltage Range	100 - 240 V AC.
Frequency Range	50 - 60 Hz
Power Rating (absolute maximum)	350 W
Overvoltage Category	CAT II*

\* Note that this is a technical term to say that the product will expect to be plugged into a typical mains socket and experience the typical transient voltages that appear there.

### 3.3 OPERATING CONDITIONS

The product has been designed for the following operating conditions:

Parameter	Specification
Location	Indoor use
Operating Temperature	23°C ± 5°C
Storage Temperature	0°C to 50°C
Operating Relative Humidity	70% (non-condensing)
Altitude	Up to 2000 m
Pollution Degree	2*

\* Note that this is a technical term to say that normally only non-conductive pollution occurs; occasionally, however, a temporary conductivity caused by condensation must be expected.

- This product has not been designed to operate correctly in direct sunlight, so it should be avoided.
- The term “indoor use” also implies that it is not designed to expect water spills.
- Whilst running an experiment try to keep room temperature as stable as possible.

### 3.4 ELECTRICAL INTERFACE SPECIFICATIONS

This section is focused on the electrical specifications of the interfaces, rather than their operation. Information on operation may be found in **Section 6 Operation**. The following figures show the front and rear panels of the product with the connectors referred to in this section.



### 3.4.1 MPU INTERFACE

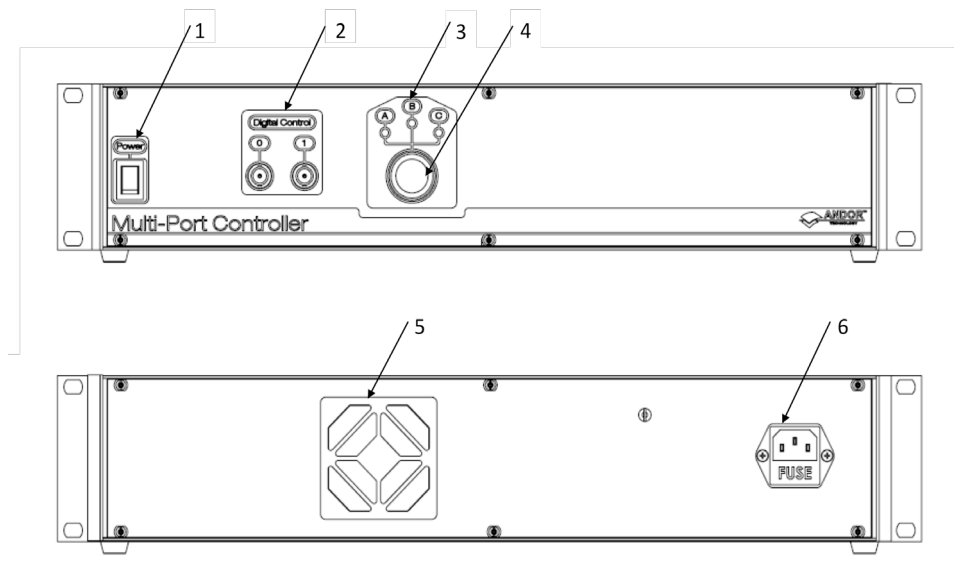


Figure 9: MPU Controller Interface

**Key:**

1. Power Switch with Integral Power-On LED
2. MPU Digital Control
3. Port Status LED Indicator
4. Galvo Cable
5. Fan Exhaust Vent
6. AC Mains

### 3.4.2 MPU DIGITAL CONTROL

This interface is used for control of the MPU from software via the PCU.

**Connector Type:** BNC Female (50 ohm size)

**Signal Type:** Digital Input

**Electrical Specification:** This is a dedicated connection to the PCU and is not designed for other uses.

### 3.4.3 MPU GALVO CABLE

This is a dedicated connection between the MPU Controller and the MPU Head for control of the galvanometer and is not designed for other uses.

### 3.5 MECHANICAL SPECIFICATIONS

Parameter	Specification
Enclosure Type	19" Sub-rack BS EN 60297
Aluminium Construction	50-60 Hz
Width	483 mm
Height	95 mm
Depth	324 mm*
Weight	5 kg
Finish	Painted: Housing, Front Panel
Ingress Protection	IP20†

\* Excluding connected cables front and rear, but including handles.

† Protection against fingers or other object not greater than 80 mm in length and 12 mm in diameter. Not protected from harmful entry of various forms of moisture (e.g. dripping, spraying, submersion, etc.)

### 3.6 TRANSPORT & STORAGE SPECIFICATIONS

- The packaging used for the original delivery should be retained for further use.
- This product must be shipped in accordance with the international standard ETS 300119 Class 2.1.
- System functional performance shall be maintained following exposure to a Storage/Transportation temperature range of -30°C to 60°C
- The crate must be protected from excesses of weather.
- Shipping crate(s) must be wheeled, wooden and conform to ISPM15 regulations.
- Relative humidity must not exceed 90% (non-condensing).

Parameter	Specification
Shipped Dimension	650 × 580 × 430 mm (25.6 × 22.83 × 16.93 inches)
Approximate Shipped Weight	10.1 Kg

This is for the MPU Controller only. The MPU Head is shipped integral with the ALC

Please note that the product's cardboard box will be packed along with other boxes inside a larger wooden crate.

### SECTION 4: FEATURES AND FUNCTIONALITY

#### 4.1 THE REVOLUTION XD SYSTEM

The Revolution XD System provides a framework for Andor's laser spinning disk, live-cell confocal microscopy solutions, which combine our award winning iXon Electron Multiplying CCD (EMCCD) camera with the renowned Yokogawa CSU-X1.

The Revolution XD System (shown below) encompasses a range of complementary components, both hardware and software, that fit seamlessly together creating a complete confocal microscopy solution. A flexible component focus also allows us to provide key pieces of hardware stand-alone.

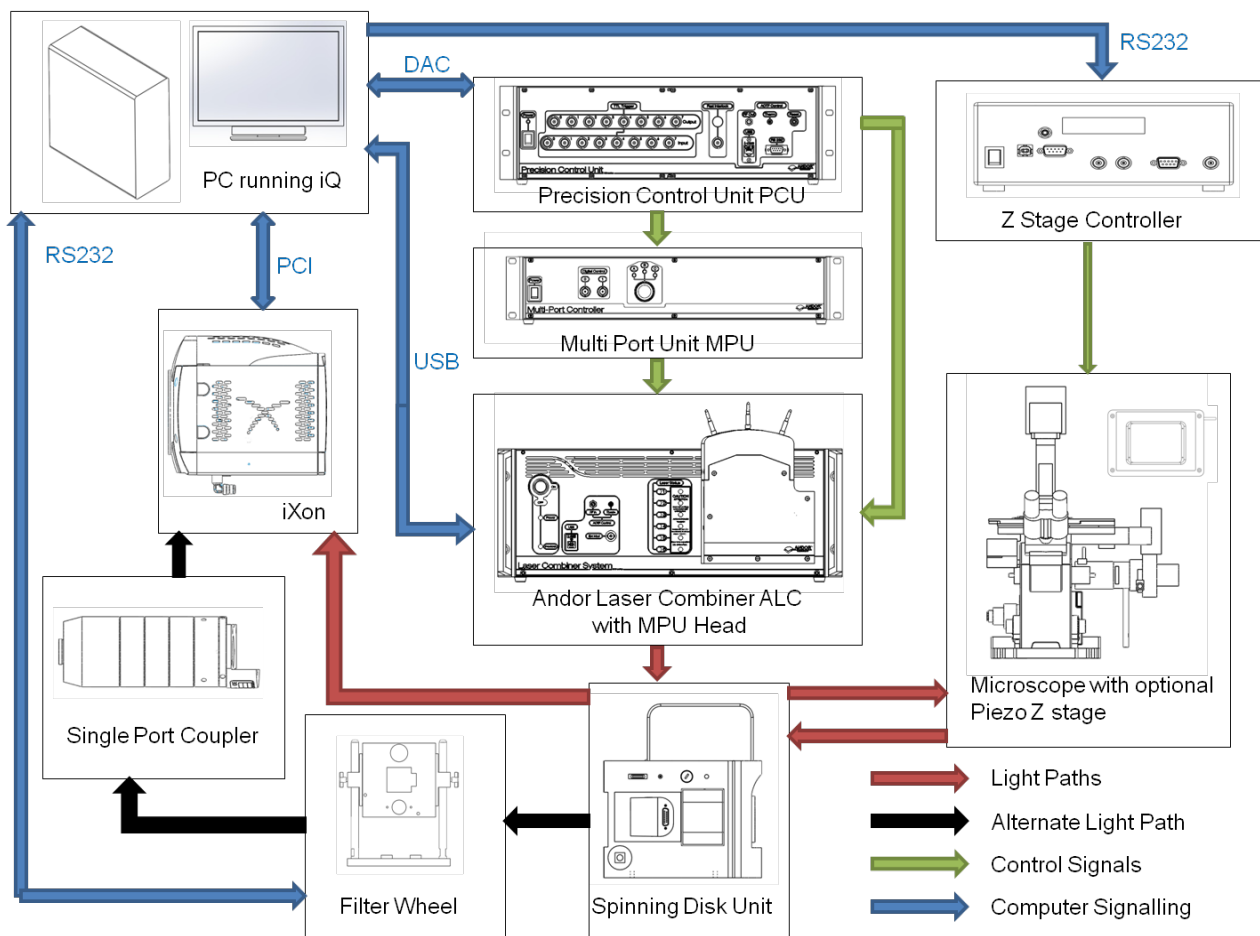


Figure 10: Representation of a typical Revolution XD Confocal Microscopy System

For information on other system components, please refer to the user guides on your Andor Product CD or supplied with the system.

## 4.2 ANDOR IQ SOFTWARE

Andor iQ (Image and Quantify) is our flagship live cell imaging software, designed with flexibility and power in mind. iQ occupies a central role in our Revolution product range and provides optimised control of Andor's award winning iXon EMCCD cameras and automation hardware for a range of bio imaging applications.

Continuous development and improvement ensures that Andor iQ represents a powerful and flexible core for live cell imaging systems.

**To control the ALC you will need one of the following software packages:**

- iQ (Andor)
- Metamorph
- Nikon Elements

See **Section 5.2.7 - Software Installation**

## 4.3 ALC-601 LASER COMBINER FUNCTIONS

The ALC is the primary laser excitation source of the Revolution XD Microscopy System.

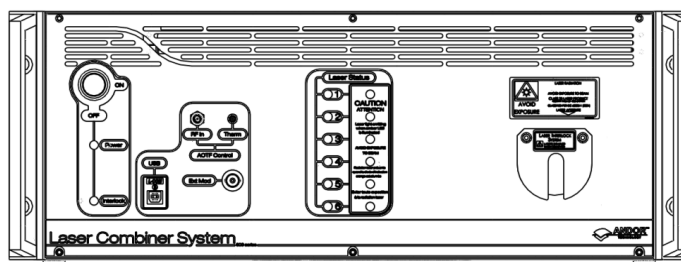


Figure 11: Standard ALC-601

The ALC-601 has the following functions:

- Houses, powers and controls up to 6 lasers in the range 400 – 660 nm.
- Combines the light from these lasers within the unit.
- Facilitates wavelength selection via an AOTF (Acousto-Optical Tuneable Filter).
- Allows combined laser light to exit the unit via an armoured, single-mode, polarisation-maintaining optical fibre, which is used to excite fluorescent chemicals in the living cells under examination
- Is controlled by the external PCU (Precision Control Unit) AOTF signals, and PC-based Andor iQ software via a USB port

Please note that the ALC requires a Precision Control Unit (PCU) to function. Information for this is covered in the PCUB-110 User Guide

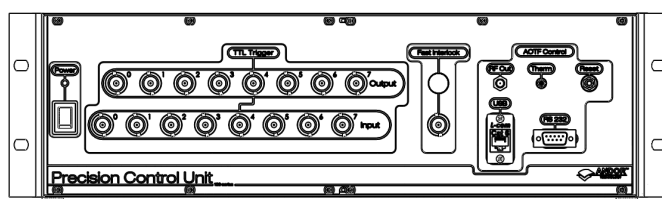


Figure 12: The PCU

## 4.4 MPU HEAD FUNCTIONS

The MPU head attaches to the laser aperture of the ALC601 detailed in the previous section.

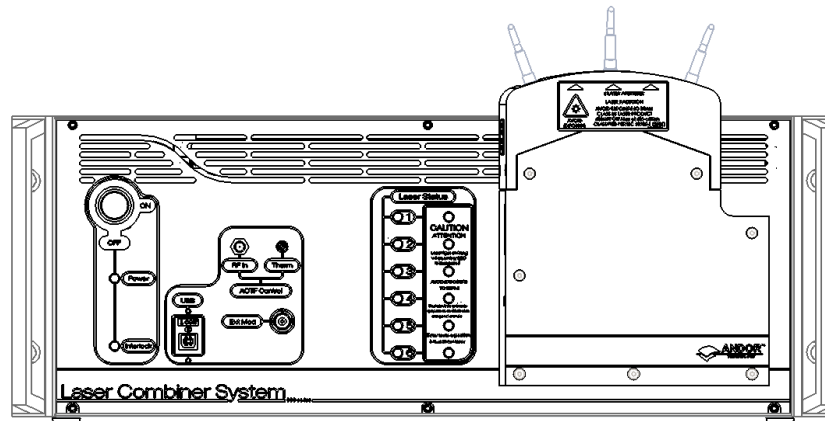


Figure 13: ALC-601 with MPU Head

The MPU head has the following functions:

- Allows the laser light output of the ALC to be efficiently coupled into a single mode fibre through one of up to three ports and thereafter safely directed to one of several possible microscopy system accessories, typically:
  - **CSU:** Confocal scanning unit.
  - **FRAPPA:** Photo-activation unit.
  - **TIRF:** Total internal reflection fluorescence attachment.
- Can be used with any customer optical accessory designed to accept a single-mode fibre input in the wavelength range 400 to 650 nm however the fibre output face angle and orientation required will be dependent on the attached accessory.

Please note that the MPU head requires a MPU controller to function.

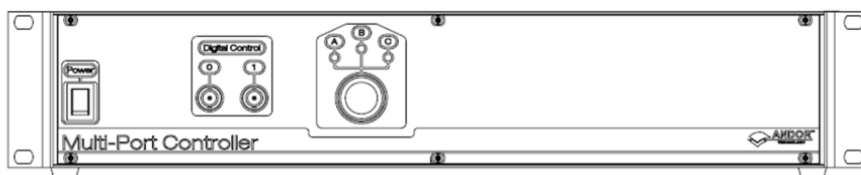


Figure 14: MPU Controller

## 4.5 SYSTEM OVERVIEW

### 4.5.1 STANDARD ALC-601 SCHEMATIC

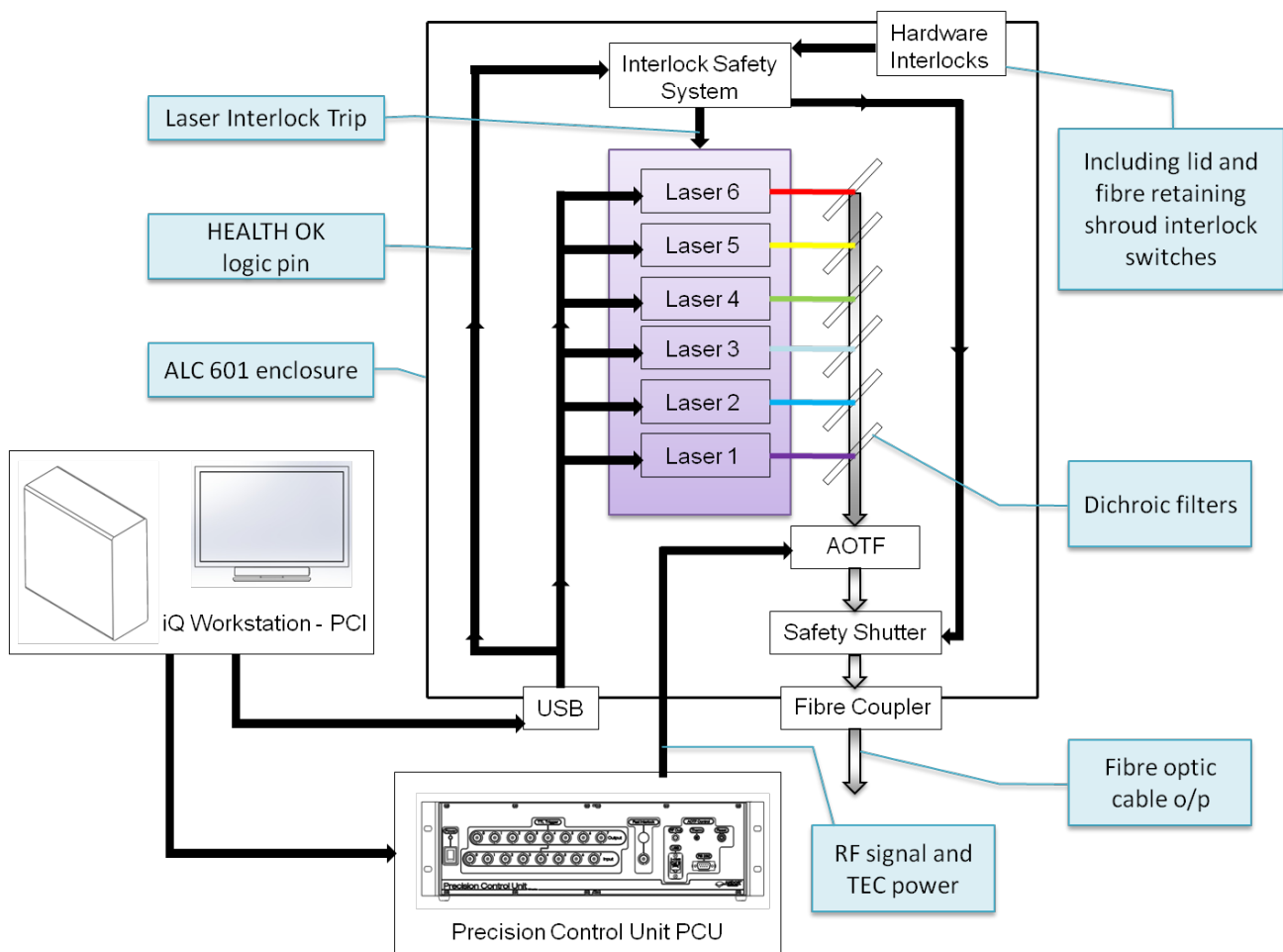


Figure 15: Standard ALC-601 System Schematic

### 4.5.2 STANDARD ALC-601 SYSTEM CONTROL

1. The ALC must be interfaced to both an iQ workstation and an Andor Precision Control Unit (PCU) for full operation.
2. The iQ workstation communicates with the ALC via a USB interface.
3. The iQ Workstation connects to the PCU via a PCI digital acquisition card (DAQ) and a 37-way D type connector cable.

## 4.5.3 ALC-601 WITH MPU SCHEMATIC

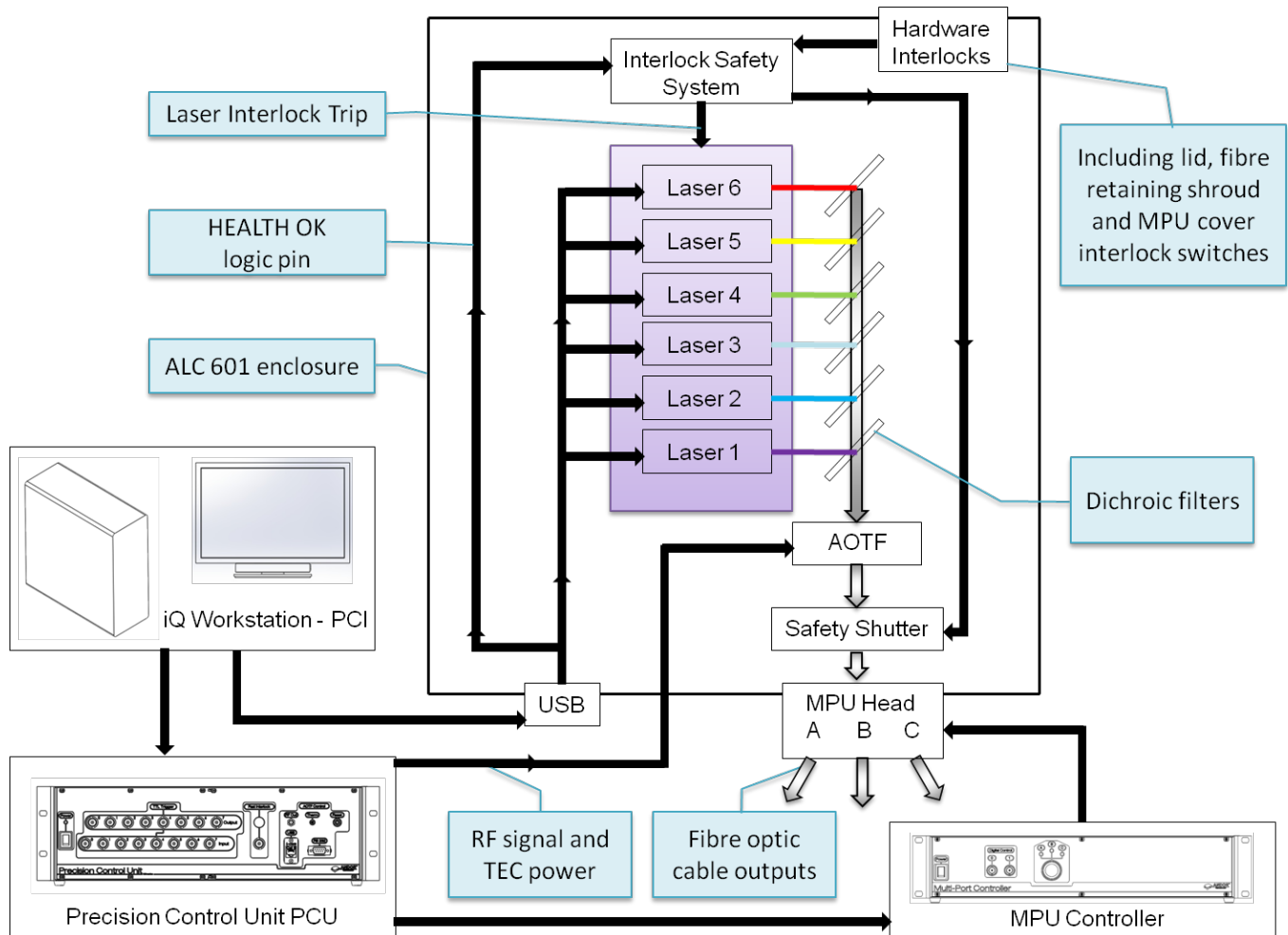


Figure 16: ALC-601 with MPU System Schematic

## 4.5.4 ALC-601 WITH MPU SYSTEM CONTROL

1. The ALC must be interfaced to both an iQ workstation, an Andor Precision Control Unit (PCU) and MPU controller for full operation.
2. The iQ workstation communicates with the ALC via a USB interface.
3. The iQ Workstation connects to the PCU via a PCI digital acquisition card (DAQ) and a 37-way D type connector cable.
4. The iQ Workstation connects to the MPU via the PCU and 2 coaxial cables

### 4.5.5 MPU SCHEMATIC

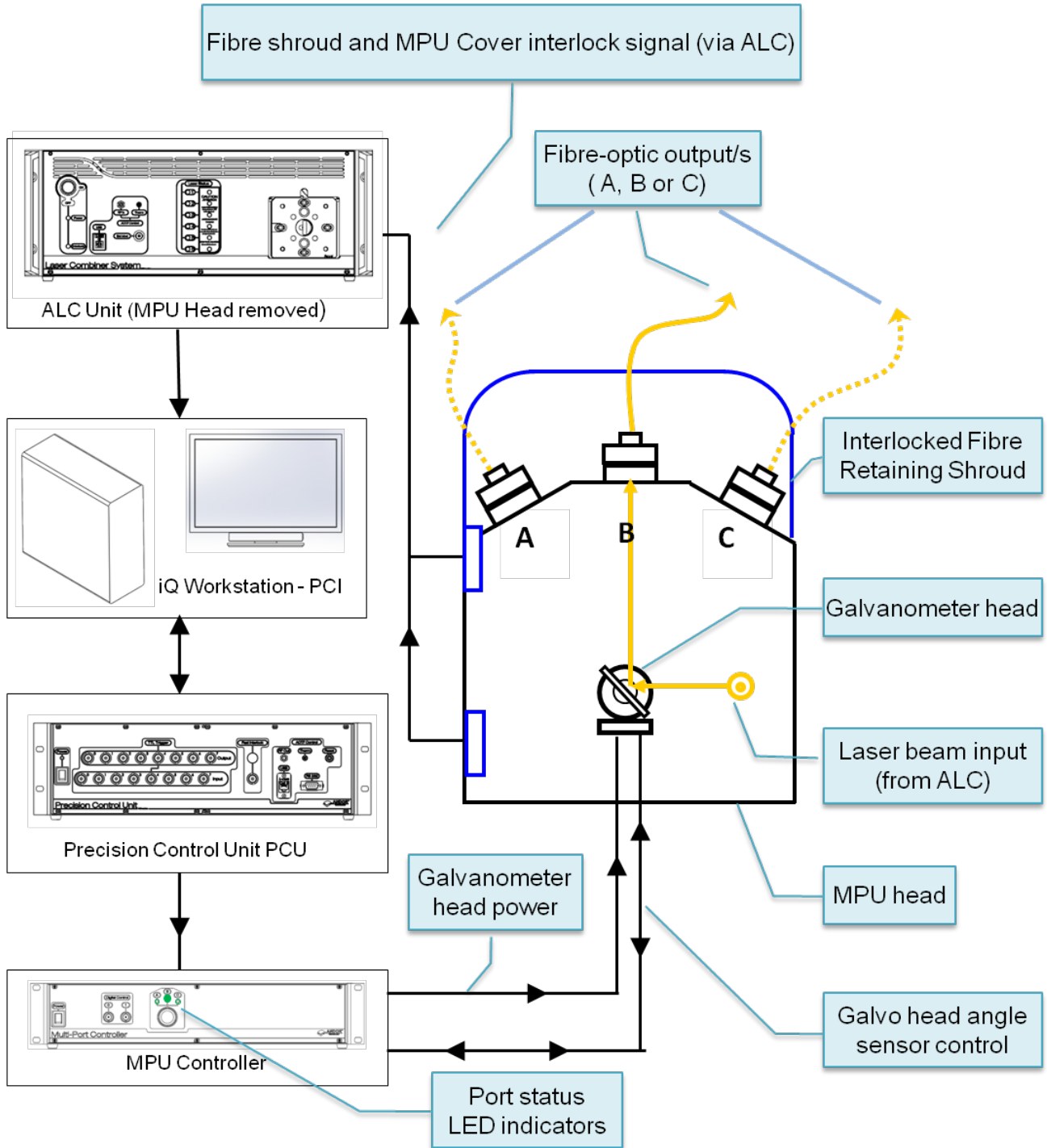


Figure 17: MPU Head Schematic



## 4.6 OPTICAL LAYOUT

### 4.6.1 OPTICAL LAYOUT, COMMON

Up to six different lasers may be configured inside the ALC-601 system. These are fitted in ascending wavelength order and the different beams are made co-linear using high-efficiency dichroic mirrors.

The lasers and all optics are mounted inside a rigid aluminium laser structure. This structure is in turn mounted inside the ALC-601 enclosure (19" sub-rack case). Every laser is interfaced to the interlock safety system and laser emission is only possible if the interlock system is in the CLOSED state. In the OPEN state, the lasers switch off immediately. This interlock action overrides any other control commands to the laser.

Fast laser wavelength selection and modulation is possible using the Acousto-Optic Tuneable Filter (AOTF). The AOTF employed has an extinction ratio of > 50dB. The AOTF is a diffractive device and the selected line (first order) is directed by the AOTF towards the fibre coupler. The rejected wavelengths (zero order) exit the AOTF at a different angle and are attenuated by a baffle plate. The AOTF is controlled (laser wavelength selection and intensity modulation) via the PCU.

The safety shutter is electrically connected to the laser interlock system. The shutter control is interfaced to the interlock safety system and the shutter can only be opened when the interlock safety system is in the CLOSED state. In the OPEN state the safety shutter closes. The laser beam cannot exit the sealed laser compartment when the shutter is closed. In addition, the shutter incorporates a switch which allows direct monitoring of the shutter state so an unsuccessful attempt to open/close the shutter, or shutter failure, is automatically diagnosed by the control software. The shutter vanes are spring loaded and the shutter is therefore more likely to fail in the safe, closed position. The safety shutter is rated for > 500,000 operations.

### 4.6.2 OPTICAL LAYOUT, STANDARD ALC-601 SPECIFIC

The selected laser wavelength(s) then pass to the fibre coupler. The fibre coupler consists of a lens and an "FC" style fibre connector. Alignment of the focused laser beam into the core of the fibre optic is achieved by adjustment of the laser beam relative to the lens and the fibre core. This adjustment is set in the factory and should usually not need re-adjusted; however, the alignment requirements for optimum performance into a single-mode fibre are such that coupler re-alignment may be eventually required (contact your local Andor representative for further advice and details). The fibre coupler is covered with a fibre retaining shroud. This shroud physically protects the coupler and also helps prevent unintentional removal of the fibre optic cable from the ALC. Removal of the shroud activates the laser interlock system and helps protect the user from un-intentional exposure to laser radiation.

The fibre optic cable is a "FC" style, single-mode, polarization maintaining. The standard option has an angled input face to reduce back-reflections to the lasers and a flat output face. Coupling efficiencies up to 90% are achievable (wavelength dependent). The fibre is enclosed in a rugged protective steel jacket which protects the fibre from damage and will also contain any laser radiation escaping from a damaged or broken fibre. It is very important to treat the fibre optic cable with care and to particularly avoid any contact with the output face of the fibre as any dirt or damage on the end face can greatly reduce the quality of the light output.

The laser path is totally enclosed so that the user is not exposed to any unnecessary or dangerous levels of laser radiation. Normally the laser beam is only visible as a highly divergent beam at the sample area of the attached accessory. During normal operation the various enclosure lids and shrouds must be fitted. If not, the laser safety interlock operates and laser emission is not possible from the ALC.

### 4.6.3 OPTICAL LAYOUT, ALC-601 WITH MPU HEAD SPECIFIC

The selected laser wavelength(s) then passes into the MPU head which incorporates a galvanometer mirror capable of rotation, thereby allowing the laser light output of the ALC to be coupled into one, of up to three, single-mode fibre couplers.

Each fibre coupler consists of a lens and an “FC” style fibre connector. Alignment of the focused laser beam into the core of the fibre optic is achieved by adjustment of the laser beam relative to the lens and the fibre core. This adjustment is set in the factory and should usually not need re-adjusted; however, the alignment requirements for optimum performance into a single-mode fibre are such that coupler re-alignment may be eventually required (contact your local Andor representative for further advice and details). The fibre couplers are covered with a fibre retaining shroud. This shroud physically protects the three couplers and also helps prevent un-intentional removal of a fibre optic cable from the MPU. Removal of the shroud activates the laser interlock system and helps protect the user from un-intentional exposure to laser radiation.

The fibre optic cable is a “FC” style, single-mode, polarization maintaining. The standard option has an angled input face to reduce back-reflections to the lasers and a flat output face. The fibre is enclosed in a rugged protective steel jacket which protects the fibre from damage and will also contain any laser radiation escaping from a damaged or broken fibre. It is very important to treat the fibre optic cable with care and to particularly avoid any contact with the output face of the fibre as any dirt or damage on the end face can greatly reduce the quality of the light output

The laser path is totally enclosed so that the user is not exposed to any unnecessary or dangerous levels of laser radiation. Normally the laser beam is only visible as a highly divergent beam at the sample area of the attached accessory. During normal operation the various enclosure lids and shrouds must be fitted. If not, the laser safety interlock operates and laser emission is not possible from ALC-601 into the MPU.

## 4.7 INTERLOCK SAFETY SYSTEM

The ALC incorporates an interlock safety system. This system is designed to prevent the user from being accidentally exposed to the potentially high level of laser radiation present inside the ALC system.

The interlock system is operated by several hardware interlock switches which are mechanically interfaced to panels, the removal of which could potentially allow access to laser radiation. In addition to the hardware interlocks being in circuit, the state of some electronic components under the control of the iQ software must also be in correct state and only then when all these conditions are satisfied will the system permit emit radiation.

## SECTION 5: INSTALLATION

This product will usually be supplied as part of a system, and will be installed by Andor Installation Technician or a trained Andor Systems distributor. The following is only provided to augment this.

### 5.1 ALC AND MPU CONTROLLER INSTALLATION

#### 5.1.1 LOCATION AND MOUNTING

- Temperature and humidity must meet the specifications shown in;
  - **ALC: Section 2.3 Operating Conditions**
  - **MPU: Section 3.3 Operating Conditions**
- Operational vibrations should be reduced as much as possible.
- Usually the product will be installed in a cabinet. However, if this is not the case, then ensure that the product is placed on a surface suitable for the weight and size of the product as defined below and conforming to the other requirements in this document, e.g. ventilation.
  - **ALC: Section 2.6 Mechanical Specifications**
  - **MPU: Section 3.5 Mechanical Specifications**
- If a cabinet is used, it should not be placed tightly against a wall.
- Power cabling and control cables should be routed to prevent accidents, damage and accidental unplugging.

#### 5.1.2 VENTILATION

- The ALC has 2 fan exhaust outlets on the rear panel, with an air intake on the front panel.
- The MPU Controller has 1 fan exhaust on the rear panel, with an air intake on the underside of the enclosure.
- To prevent equipment failure, ensure that there are no obstructions at either the air intake or fan exhausts.
- The product should have a 1U air gap below when installed in a rack, or ensure it stands on its supplied feet if desk-mounted.
- Clearance to the rear should be a minimum 100 mm.

#### 5.1.3 ASSEMBLY

This product itself requires no assembly. Cables connections are covered in Section 5.2 Cabling Installation

### 5.1.4 POWER CONNECTION AND PROTECTIVE EARTHING

- See **Section 6.1 Emergency Disconnection**
- Before connection, check that the mains power socket used can provide the power as specified;
  - **ALC Section 2.2 Power Supply**
  - **MPU Section 3.2 Power Supply**
- Always switch off power before connecting/ disconnecting cables from the product.
- A mains power cable is provided with this product, but ensure that it satisfies local regulations for safety.
- Mains power is connected via the 3-pin IEC C14 connector on the rear panel of the product.
- An integral part of protection against electric shock in the case of a fault is the protective earth provided via the earth conductors in the mains cable. It is therefore vital that the earth system of the building, and in particular the socket, is constructed properly to provide suitable protection when needed.
- Do not pull cables by the sheath. Use the connector body.

## 5.2 CABLING INSTALLATION

### 5.2.1 POWER CABLING

See **Section 5.1.4 Power Connection and Protective Earthing**

### 5.2.2 ALC AOTF CABLING

Connect the supplied SMA and SMC coaxial cables between the RF and Therm ports on the ALC and the PCU.

Ensure that these are fitted without damage to the connectors and that they lock, but are only finger-tight. Overtightening may damage the connectors.

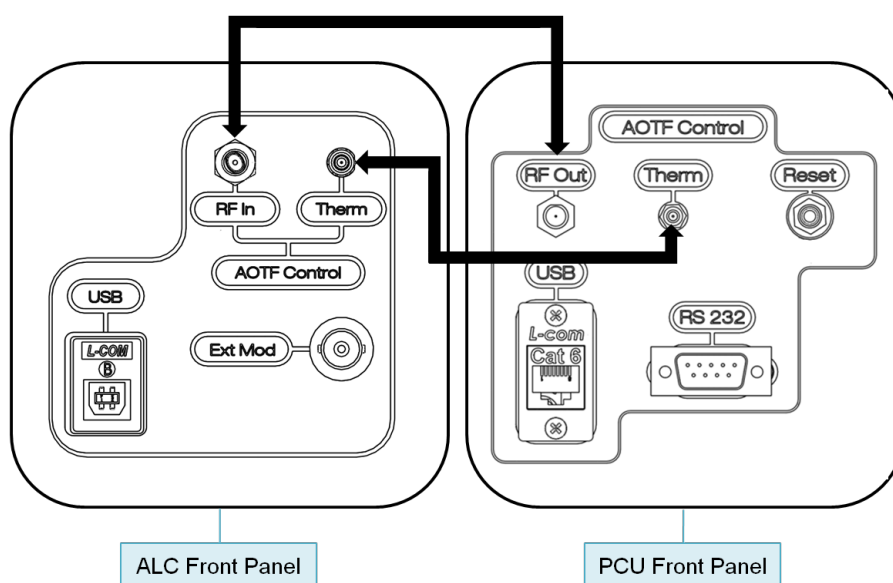


Figure 18: AOTF Interconnection Cables between ALC and PCU

### 5.2.3 ALC USB CABLING

The ALC should be connected using the supplied USB cable to your PC.

### 5.2.4 ALC OPTICAL FIBRE

For standard ALC-601 see;

- **Section 6.4.7 Fibre Retaining Shroud**
- **Section 6.4.8 Fibre Interlock Microswitch**

For ALC-601 with MPU see;

- **Section 6.5.1 Fibre Retaining Shroud**
- **Section 6.5.2 MPU Fibre Interlock Switch**

### 5.2.5 MPU DIGITAL CONTROL CABLING

Connect the supplied coaxial cables between the Digital Control ports on the MPU Controller and the TTL Trigger ports on the PCU.

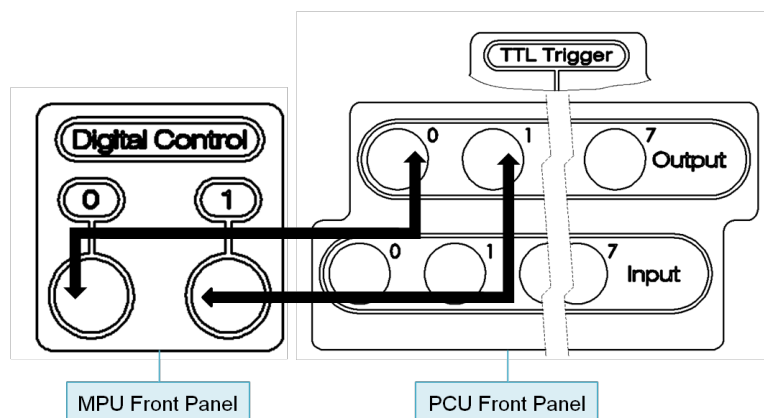


Figure 19: Digital Control Cabling between the MPU and PCU

### 5.2.6 MPU GALVO CABLING

The MPU Galvo Cabling involves accessing the interior of the MPU Controller. Contact Andor technical support if this is required. See Section 1.1 Help & Technical Support.

### 5.2.7 SOFTWARE INSTALLATION

See iQ User Guide for details.

### 5.2.8 REMOTE INTERLOCK

All ALC systems are supplied with a safety interlock kit (Revolution XD interlock cable assembly).

If further external interlocks, e.g. doors, need added, the modular nature of the Revolution XD interlock cable assembly allows for further interlocks to be added. Please contact Customer Support to arrange this.

## SECTION 6: OPERATION

If the equipment is used in a manner not specified by Andor, the protection provided by the equipment may be impaired.

### 6.1 EMERGENCY DISCONNECTION

In case of emergency, the disconnecting device is the mains lead. This will either be the mains lead connected to the product, or in the case of a cabinet-based system the mains lead to the cabinet.

SWITCH OFF THE MAINS SOCKET AND REMOVE THE MAINS LEAD FROM THE PRODUCT.

### 6.2 INSTRUCTIONS FOR USE

The main operation of this product is as part of the wider Revolution XD system and this is covered in the iQ User Guide and by the training given by your Andor Installation Technician or trained Andor Systems distributor.

### 6.3 REAR PANEL CONNECTIONS

#### 6.3.1 TTL LASER CONTROL

Allows the user the option of external modulation of the diode lasers via TTL control. The lasers are individually switched from internal control to TTL control within iQ

#### 6.3.2 AC MAINS INPUT

Connects the ALC to a local AC supply and includes an integral replaceable fuse.

### 6.4 STANDARD ALC-601: FASCIA CONNECTIONS, CONTROLS AND INDICATORS

The main controls and indicators of the ALC are on the front of the unit as shown below:

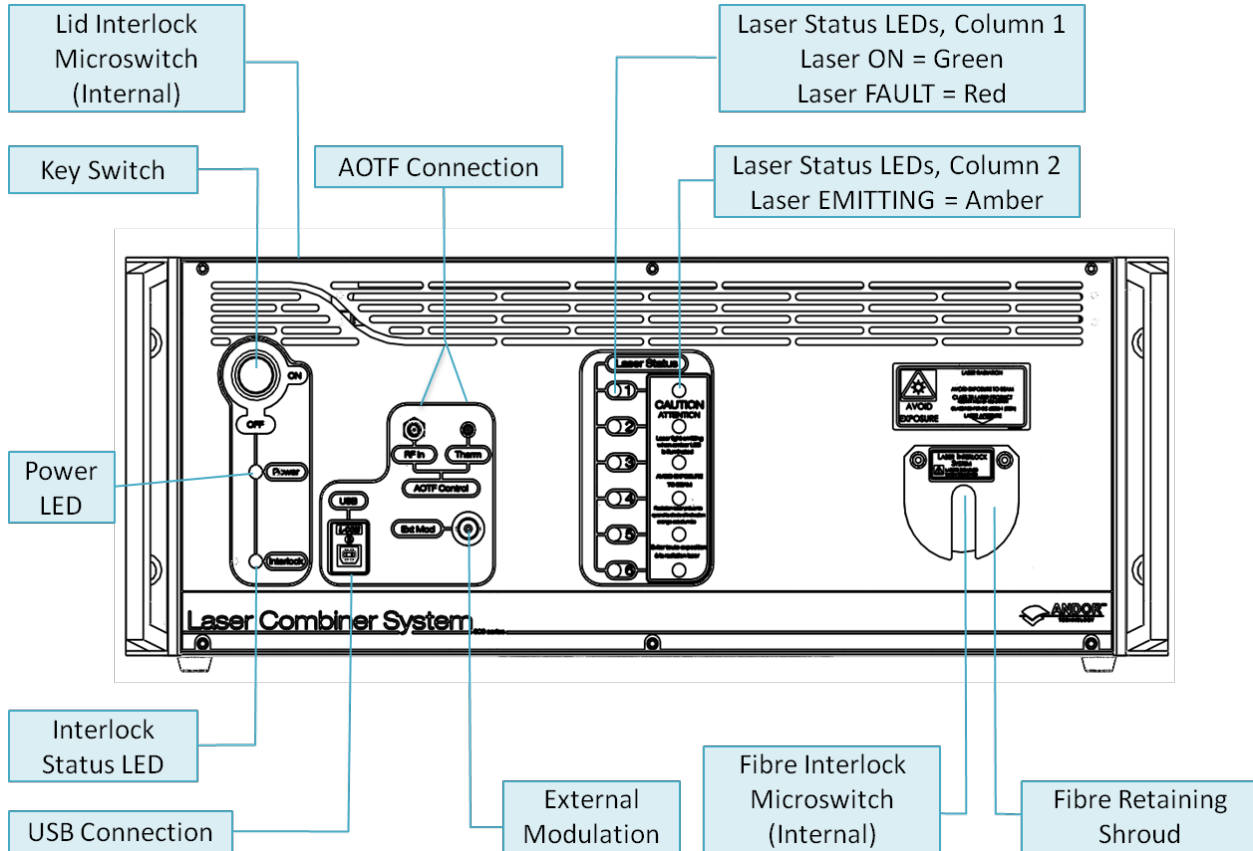


Figure 20: Standard ALC-601 Fascia Panel

#### 6.4.1 KEY SWITCH

The system can only be powered on with the use of this Key Switch. The operation of the Key Switch is such that the key cannot be removed from switch when it is in the ON position. The Key Switch is used to restrict access to authorised/trained users only.

Please note that this does not cut mains power to the ALC completely and should not be used for emergency disconnection. See Section 6.1 Emergency Disconnection

#### 6.4.2 POWER LED

The Power LED gives an indication of a successful power ON condition and illuminates (green) when mains power is supplied to the unit and the Key Switch is in the ON position.

#### 6.4.3 INTERLOCK STATUS LED

The Interlock Status LED illuminates (red) when any of the hardware interlock switches are in the OPEN state. In the OPEN interlock state laser emission is NOT possible from the ALC – contact Andor Technical Support (**Section 1.1 Help & Technical Support**)

#### 6.4.4 USB CONNECTION

Connects the ALC to a designated USB port on the iQ Workstation PC. The ALC unit is controlled by Andor iQ software via this interface (except for the AOTF, which is controlled by the PCU).

#### 6.4.5 EXTERNAL MODULATION

BNC connection allowing the external modulation of up to 4 Diode lasers at high frequency as required for FLIM - fluorescence life time imaging. This feature requires additional optional internal hardware which can be retrofitted on site if required.

#### 6.4.6 LASER STATUS LED INDICATORS

There are a total of twelve LED indicators, two for each of six lasers housed. The twelve LEDs are arranged into two columns, see Figure 19. The first column contains bi-colour LEDs to indicate either 'LASER ON/READY' (Green) or 'FAULT' (Red). The second column indicates if the laser is 'LASER EMITTING' (Amber)

##### **FAULT Indicators**

When illuminated, these red LEDs give an indication of a possible error with that laser. If this occurs, please contact your local Andor representative as shown in **Section 1.1 Help & Technical Support**.

##### **LASER ON/READY Indicators**

When illuminated, these green LEDs provide a visual indication that the following criteria have been met:

- Power is applied to the appropriate laser system.
- Software control has been established.
- The laser diode initialisation process has completed.
- The laser is emitting light.
- The laser light output power (P) has stabilized between 95 and 105% of the set laser power (PSET) [ $0.95.Pset < P < 1.05.Pset$ ].

##### **LASER EMITTING Indicators**

These amber LEDs provide a visual indication that laser radiation is being emitted from the system. For this to occur, the following conditions must be satisfied:

- A Laser is ON and lasing (appropriate LASER indicator is illuminated)
- The Safety Shutter is OPEN
- Laser Line selected (PCU unit powered on and connected to iQ Workstation)

Due to the rapid wavelength selection possible with the ALC, the Emission Indicators are not synchronised with the "actual" laser emission. For example if a software protocol is written so that the laser combiner will be repeatedly switching one or more laser lines then the appropriate LEDs for each selected laser will be illuminated for the duration of the protocol, or for as long as the ALC is emitting laser light.



### 6.4.7 FIBRE RETAINING SHROUD

The Fibre Retaining Shroud is attached to the front panel of the ALC and covers the output side of the fibre coupler and the FC style connector and receptacle. The connector cannot be accessed and therefore the fibre cannot be detached from the ALC while the shroud is attached.

This shroud is fitted during system installation and does not normally need to be removed during normal operation of the system.

### 6.4.8 FIBRE INTERLOCK MICROSWITCH

The Fibre Interlock Microswitch is mounted internally behind the ALC front panel. The switch is positioned so that it is only actuated when the fibre retaining shroud is located correctly on the ALC unit. If the fibre retaining shroud is loosened the interlock safety circuit will be activated and laser light emission from the ALC unit will cease immediately.

### 6.4.9 LID INTERLOCK MICROSWITCH

This Lid Interlock Microswitch is mounted internally on the top, left-hand side of the ALC. The switch is positioned so that it is only actuated when the lid is located correctly on the ALC unit. If the lid is removed the switch will open, the interlock safety circuit will be activated and laser light emission from the ALC unit will cease immediately.

### 6.4.10 AOTF CONNECTION

RF Out: Supplies the drive signal used to activate the Acousto-Optical Tuneable filter (AOTF) head (SMA type connector)

Therm: Supplies power to the temperature stabilization circuitry of the AOTF head (SMC type connector). These inputs are connected to the matching connector on the matching PCU unit with the supplied SMA and SMC cables.

**NOTE: IT IS IMPORTANT THAT THE “RF OUT” CONNECTOR OF THE PCU UNIT IS CONNECTED TO AN ALC UNIT BEFORE SWITCHING ON. FAILURE TO DO SO MAY RESULT IN DAMAGE TO THE PCU UNIT.**

## 6.5 ALC-601 WITH MPU HEAD: FASCIA CONNECTIONS, CONTROLS AND INDICATORS

The fascia connections, controls and indicators are the identical to those as detailed for the standard ALC-601 with the exception of the items detailed below.

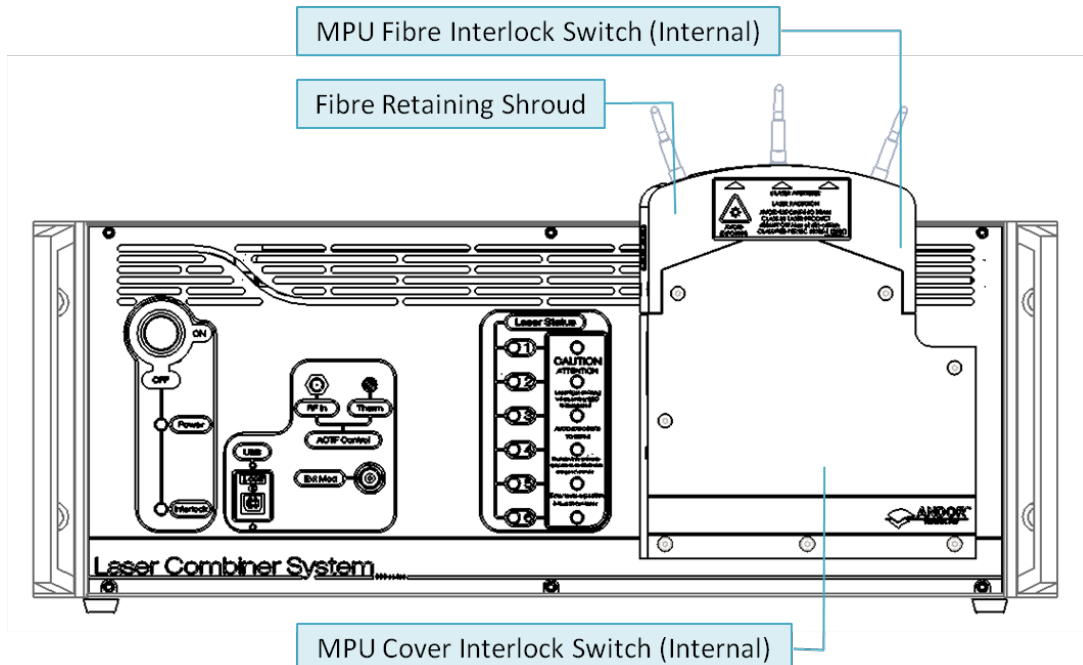


Figure 21: ALC-601 with MPU Head Fascia Panel

### 6.5.1 FIBRE RETAINING SHROUD

The Fibre Retaining Shroud is attached to the main body of the MPU Head and covers the output side of the fibre couplers and the FC style connectors and receptacles. The connectors cannot be accessed and therefore the fibre cannot be detached from the ALC while the shroud is attached.

This shroud is fitted during system installation and does not normally need to be removed during normal operation of the system.

### 6.5.2 MPU FIBRE INTERLOCK SWITCH

The MPU Fibre Interlock Switch is mounted internally within the MPU Head. The switch is positioned so that it is only actuated when the fibre retaining shroud is located correctly on the MPU head. If the MPU fibre retaining shroud is loosened the interlock safety circuit will be activated and laser light emission from the ALC unit will cease immediately.

### 6.5.3 MPU COVER INTERLOCK SWITCH

The MPU Cover Interlock Switch is mounted internally within the MPU Head. The switch is positioned so that it is only actuated when the MPU cover is located correctly on the MPU head. If the MPU cover is loosened the interlock safety circuit will be activated and laser light emission from the ALC unit will cease immediately.

## 6.6 MPU CONTROLLER: FASCIA CONNECTIONS, CONTROLS AND INDICATORS

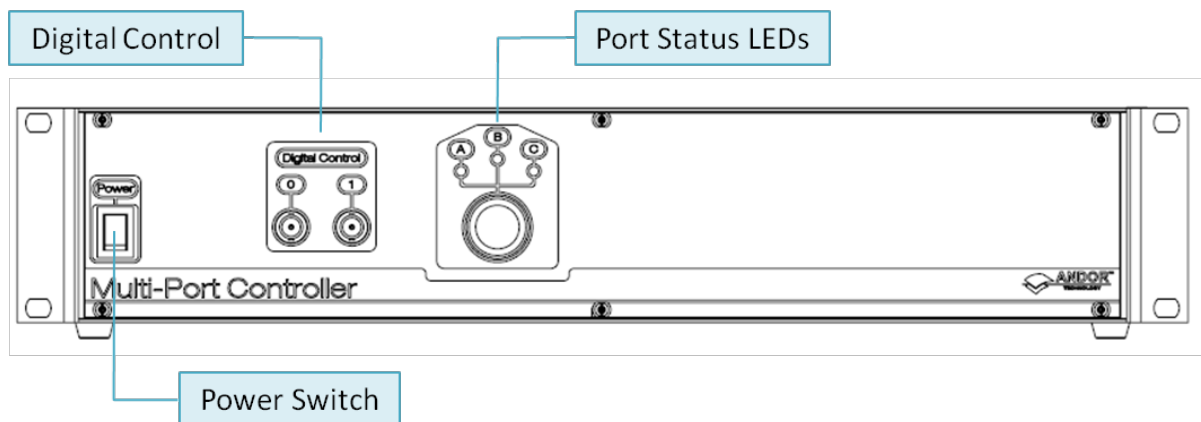


Figure 22: MPU Controller Fascia Panel

### 6.6.1 POWER SWITCH

The MPU Controller can only be powered on with the use of this Power Switch. The switch has an integral LED which illuminates red when the unit is operational.

Please note that this does not cut mains power to the MPU completely and should not be used for emergency disconnection. **See Section 6.1 Emergency Disconnection.**

### 6.6.2 DIGITAL CONTROL

Connects the MPU to the iQ workstation, via the PCU, thereby facilitating iQ positional control of the galvanometer mirror within the MPU head.

### 6.6.3 PORT STATUS LEDs

Gives a visual indication of which output port on the MPU head is currently being used for laser emission.

## 6.7 INTERLOCK SAFETY SYSTEM OPERATION

The MPU and ALC interlock safety systems are interconnected.

If any of the interlock switches are disturbed;

1. Laser emission will stop immediately.
2. The safety shutter (within the main ALC-601 enclosure) will close automatically.
3. The interlock status indicator will illuminate.
4. The interlock status is reported to the software control interface (iQ).
5. The iQ software will report the interlock error as shown in the following figure.

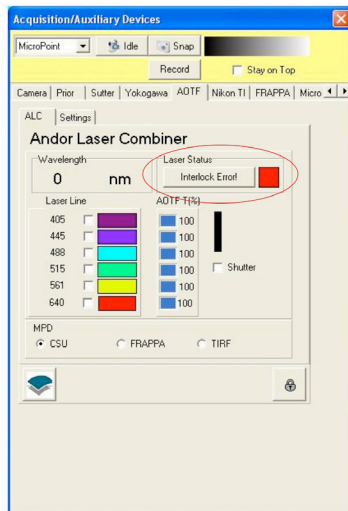


Figure 23: iQ Interlock Error Message

To re-initiate laser emission after the interlock system has been tripped please carry out the following actions;

1. Determine which part of the interlock circuit has been disturbed and re-instate correctly.
2. When completed successfully the interlock status indicator will extinguish.
3. Laser emission will not re-commence until the user presses the RESET button on the SETTINGS tab of the ACQUISITION/AUXILIARY DEVICES window as shown in the following figure.:

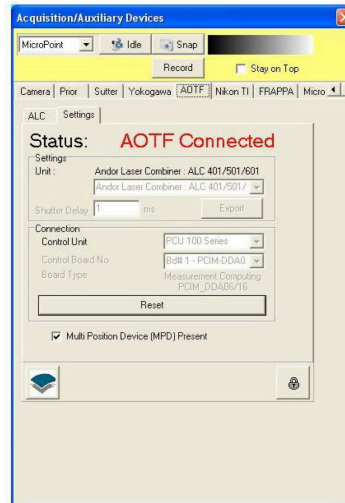


Figure 24: Reset after Interlock Error

In the following sub-sections the interlock system is defined as being in the CLOSED state when all of the hardware safety interlock switches/connectors are CLOSED. Laser radiation can only be emitted from the ALC-601/MPU when the interlock system is in the CLOSED state. The electronics logic is designed to minimize any risk caused by faulty wiring. In these cases the system defaults to a safe operating state:

i.e. an OPEN interlock state → No laser emission possible from ALC-601/MPU

### 6.7.1 CONDITIONS FOR LASER EMISSION FROM THE ALC

Laser radiation can only enter the MPU head when all the conditions for laser emission from the ALC have been satisfied:

1. AC Power is applied to the ALC system and the Power Switch (key switch) is ON.
2. All ALC interlocks must be in the CLOSED state.
3. Electronic status confirmed as OK.
4. The laser/s must be successfully turned on by the software control interface.
5. The appropriate laser line must be selected using the AOTF device.
6. The safety shutter must be actively opened using the software control interface.
7. The appropriate ALC Laser Emission Indicator will only illuminate when all these conditions have been satisfied.

### 6.7.2 CONDITIONS FOR LASER EMISSION FROM THE MPU HEAD

Laser radiation will optically couple into the MPU fibre optic cables only when the following conditions have been satisfied;

1. All of the conditions for laser emission from the ALC unit have been met (see previous).
2. Electrical power is supplied to the MPU controller and the power switch is on.
3. The MPU interlock switch is closed (i.e. the MPU cover is secured in place).
4. The MPU fibre retaining shroud interlock switch is closed (i.e. the shroud is secured in place).

## SECTION 7: MAINTENANCE

### 7.1 CLEANING AND DECONTAMINATION

To clean the product, only use a damp lint-free cloth. Do not wet the connectors. Do not use solvents, cleaning agents, or aerosols.

### 7.2 MAINTENANCE

PLEASE NOTE the following:

If the equipment is used in a manner not specified by Andor, the protection provided by the equipment may be impaired.

In case of emergency, the disconnecting device is the mains lead. This will either be the mains lead connected to the product, or in the case of a cabinet-based system the mains lead to the cabinet. See **Section 6.1 Emergency Disconnection**

#### 7.2.1 REGULAR CHECKS

The state of the product should be checked regularly, especially the integrity of the enclosure and the mains cable.

Do not use equipment that is damaged.

#### 7.2.2 ANNUAL ELECTRICAL SAFETY CHECKS

It is advisable to check the integrity of the insulation and protective earth of the product on an annual basis, e.g. U.K. PAT testing.

Do not use equipment that is damaged.

#### 7.2.3 ALC-601 FUSE REPLACEMENT

The characteristics of the fuse used in this product are as follows:

- Rated Current: 5.0 A
- Rated Voltage: 250 V a.c.
- Size: 5 × 20 mm
- Type: Time delay, low breaking capacity

The rated voltage could be lowered in North America and countries who use a similar mains supply to 125 V a.c.

The actual fuse used in this product is a *Cooper Bussmann S506-5-R*.

## 7.2.4 MPU CONTROLLER FUSE REPLACEMENT

The characteristics of the fuse used in this product are as follows:

- Rated Current: 1.0 A
- Rated Voltage: 250 V a.c.
- Size: 5 × 20 mm
- Type: Time delay, low breaking capacity

The rated voltage could be lowered in North America and countries who use a similar mains supply to 125 V a.c.

The actual fuse used in this product is a *Cooper Bussmann S506-1-R or S506-1A*.

## APPENDIX A: GLOSSARY

<b>ADC</b>	Analogue-to-Digital Converter: Converts an analogue voltage to a digital signal.
<b>ALC</b>	Andor Laser Combiner: The unit at the heart of the Revolution XD that combines laser light from several internal sources and controls their emission into the microscopy system.
<b>AOTF</b>	Acousto-Optical Tuneable Filter
<b>DAC</b>	Digital-to-Analogue Converter: Converts a digital signal to an analogue voltage.
<b>ESD</b>	Electrostatic Discharge
<b>EMC</b>	Electromagnetic Compatibility
<b>EU</b>	European Union
<b>FRAPPA</b>	Fluorescence Recovery After Photo-bleach (FRAP) and Photo Activation (PA): Imaging protocols in which a computer-steered laser beam is used to photo-bleach or photo-activate a user-defined region in the specimen.
<b>IO</b>	Input/ Output: Generic input and output electrical signal connections.
<b>iQ</b>	The PC software used to control the Revolution system.
<b>LED</b>	Light Emitting Diode
<b>MPU</b>	Multi-Port Unit: An optional addition to the ALC that uses fast galvanometer switching to switch the ALC laser light between multiple ports (usually CSU-X1, FRAPPA and TIRF)..
<b>PCI</b>	Peripheral Component Interconnect: A computer local bus standard for attaching hardware devices in a computer that can take either the form of integrated circuits fitted onto the motherboard itself, or expansion cards that fits into slots.
<b>PCU</b>	Precision Control Unit: A Revolution XD unit that provides part of the control of the system including ALC AOTF control, MPU control, TTL input interface to PC, TTL output interface from PC and analogue piezo stage control.
<b>MPU</b>	Multi-Port Unit: A special head using galvanometers to direct the laser light from an ALC through to multiple ports, together with its control box.
<b>SMA</b>	Sub-Miniature version A: Coaxial RF connectors with a screw type coupling mechanism, and available in 50 $\Omega$ impedance only.
<b>SMB</b>	Sub-Miniature version B: Coaxial RF connectors with a screw type coupling mechanism, smaller than an SMA connector, and available in 50 $\Omega$ and 75 $\Omega$ impedances.
<b>SMC</b>	Sub-Miniature version C: Coaxial RF connectors with a screw type coupling mechanism, smaller than both SMA and SMB connectors, and available in 50 $\Omega$ and 75 $\Omega$ impedances.
<b>TIRF</b>	Total Internal Reflection Fluorescence: The electromagnetic field of the Totally- Internally Reflected light extends into the sample beyond the interface by 100-200 nm into the medium of lower refractive index, so that only a very thin section of the specimen undergoes fluorescence excitation.
<b>USB</b>	Universal Serial Bus: A serial bus standard to connect devices to a host computer.



## APPENDIX B: OTHER INFORMATION

### TERMS AND CONDITIONS OF SALE AND WARRANTY INFORMATION

The terms and conditions of sale, including warranty conditions, will have been made available during the ordering process. The current version may be viewed at: [http://www.andor.com/pdfs/literature/Andor\\_Standard\\_Warranty.pdf](http://www.andor.com/pdfs/literature/Andor_Standard_Warranty.pdf)

### WASTE ELECTRONIC AND ELECTRICAL EQUIPMENT REGULATIONS 2006 (WEEE)

The company's statement on the disposal of WEEE can be found in the Terms and Conditions

