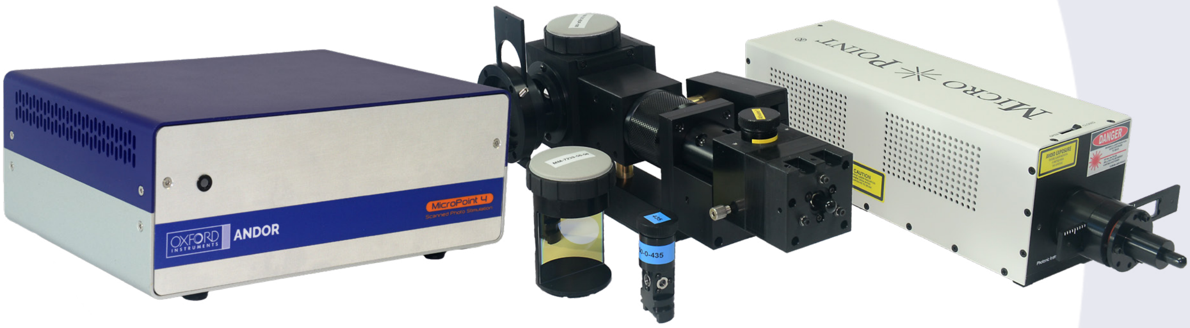
MicroPoint 4

Version 3.2 rev 29 October 2024



User Guide

For model: MP-420

Revision History

Version	Released	Description
3.0	19th September 2023	Initial release of MicroPoint 4
3.1	25th September 2023	Changed cover title to MicroPoint 4
3.2	29 October 2024	Added AI Translation disclaimer

Updates to the Manual

Changes are periodically made to the product, and these will be incorporated into new editions of the manual. Please check for new releases of the manual at: andor.oxinst.com/downloads. If you find an issue in this manual, please contact your customer support representative (“1.2 Help and Technical Support” on page 14) with a description of the issue.

Manuals for Components

There are components used in the system which have separate User Manuals. These are as follows:

Nitro NL100 Laser

Laser-Lock Interlock

ILE Integrated Laser Engine CW laser

HLE High Power Laser Engine CW laser

SAFETY AND WARNING INFORMATION

PLEASE READ THIS INFORMATION FIRST BEFORE USING YOUR PRODUCT.

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

1. If the equipment is used in a manner not specified by Andor, the protection provided by the equipment may be impaired.
2. Do not position this product so that it is difficult to operate the mains disconnecting device. See SECTION 4.2, "Emergency Mains Disconnection".
3. Before using the system, please follow and adhere to all warnings, and safety, manual handling, and operating instructions located either on the product, or in this manual.
4. Keep this manual in a safe place for future reference.
5. Users must be authorised and trained personnel only; otherwise, this may result in personal injury, and/or equipment damage and impaired system performance.
6. There are no user-serviceable parts inside the product and the enclosure must not be opened. Only authorised service personnel may service this equipment.
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. Do not attempt to bypass any safety interlocks. They are provided to comply with the safety requirements of various regulatory agencies and must be employed to protect the operator.
9. Protective earth is an integral part of the protection against electric shock in this product and is provided via the earth pin of the external power supply. Ensure that this is plugged into the building earth system via the mains socket. Do not tamper with any of the earthing measures.
10. Any External AC/DC Power Supply used with this product must meet the requirements specified in "MicroPoint 4 Controller External Power Supply Requirements" on page 65.
11. No parts should be replaced by the customer, except for the mains cables, which must be of the same type and rating as that supplied and as specified in "MicroPoint 4 Controller Electrical Power Specifications" on page 65", and certified in accordance with your region's safety regulations.
12. Make sure all cables are located so that they will not be subject to damage, especially the mains cable.
13. While running an experiment, keep room temperature as stable as possible.
14. Performance of the system may be adversely affected by rapidly changing environmental conditions or operation outside of the operating conditions specified in "Appendix A: Technical Data MicroPoint 4"
15. Ensure that adequate ventilation is provided as specified in "Appendix A: Technical Data MicroPoint 4" on page 63.
16. This product is designed to be used in an indoor environment. If the customer chooses to use this outside, then it is their responsibility to provide adequate protection. Andor assumes no liability for damage or obligation to repair under warranty relating to use outside of the environmental requirements specified in "Appendix A: Technical Data MicroPoint 4".
17. Medical Diagnosis: This equipment has not been designed and manufactured for the medical diagnosis of patients.
18. Electromagnetic Compatibility – Caution: This product was designed for and tested using the IEC/EN 61326-1 EMC standard for Class A emissions and a Basic immunity environment. Class A means that it is not designed for a domestic or residential environment, and Basic immunity refers to the fact that it is not designed for a typical industrial environment. This equipment is not intended for use in residential environments and may not provide adequate protection to radio reception in such environments.

19. Electromagnetic Compatibility: As required by IEC/EN 61326-1, we must inform you that electromagnetic emissions in excess of that required by that EMC standard for the emissions class of this product can in theory occur due to its connection to other equipment.
20. Electromagnetic Compatibility: This product has been designed and tested to perform successfully in a normal (basic) electromagnetic environment, e.g. a typical life science test laboratory, as per the EU EMC Directive. It is not designed to operate in a harsh electromagnetic environment, e.g. close to the following equipment: EMI/RFI generators, electrostatic field generators, electromagnetic or radioactive devices, plasma sources, arc welders, x-ray instruments, intense pulsed sources, or other similar sources of high energy fields whose emissions are not within the normal range expected under the EU EMC Directive.
21. This product is a precision scientific instrument containing fragile components. Always handle it with care.
22. Flammable Liquids: These are used in this product, so appropriate care should be taken in its vicinity, e.g. not using any ignition sources close to the areas where these are located.
23. Toxic substances: These are used in this product, so appropriate care should be taken as per the relevant Safety Data Sheet provided with this product.
24. Optical Fibres: It is important that you read “Working with Optical Fibres” on page 12
25. Do not wet or spill liquids on the product, and do not store or place liquids on the product.
26. If spillage occurs on the product, switch off power immediately, and wipe off with a dry, lint-free cloth.
27. If any ingress of liquids has occurred or is suspected, unplug the mains cables and do not use. Contact customer support.
28. See “5.1 Cleaning and Decontamination” on page 58.
29. Do not expose the product to open flames.
30. Do not allow objects to fall on the product.

Laser Safety Special Warnings

READ AND DO NOT IGNORE!
CAUTION – USE OF CONTROLS OR ADJUSTMENTS OR PERFORMANCE OF PROCEDURES OTHER THAN THOSE SPECIFIED HEREIN MAY RESULT IN HAZARDOUS RADIATION EXPOSURE

- This product contains lasers, so you must be aware of the hazards associated with the use of the powerful laser radiation that can be emitted by this product.
- Laser radiation is emitted by this product when the Emission Indicator LEDs are illuminated on the laser source used.
- It is extremely important that you read the user guides associated with each laser source used by MicroPoint, See section "Manuals for Components" on page 5.
- As the above user guides exist, therefore at certain points in the following warnings, we will only be referring to the MicroPoint Dye Laser generated by the NL100 UV laser pumping the dye cell.
- **WARNING:** As defined in IEC 60825-1, the MicroPoint Dye Laser is **Class 3B**, which means that it can be hazardous to the eyes when they are exposed to the beam within the Nominal Ocular Hazardous Distance (NOHD). The NOHD can vary with the pulse energy, the pulse repletion rate, the chosen dye and whether or not a microscope objective lens is fitted (which affects divergence and thus concentration of the beam). Viewing and diffuse reflections is normally safe.
- Laser classification is based on a distance of 100 mm from the laser aperture, so be aware that there is increased exposure to laser radiation at the focal point or closer to the aperture, which may be hazardous to skin and even underlying flesh.
- Great caution must thus be taken with the laser radiation emitted from this product.
- Be conscious of the path taken by the beam emitted by this product or any attached product.
- Do not expose any part of your body to the laser radiation emitted by this product or any attached product.
- Skin damage or deeper injury can be caused by lasers, but the eye is especially susceptible as laser light can be collimated into a narrow beam that can enter the eye and permanently damage the retina with life-changing consequences.
- The following labels summarise the same information and are located on the optical head attached to your microscope:

- The power indicated on this product would be very tame if it was a light bulb, but this should not deceive you as laser radiation is quite different.
- Laser radiation differs from ordinary light primarily because its optical power can be concentrated into a narrow, low-divergence beam, whereas, for example, a standard light bulb diffuses its light in all directions and thus spreads out its power. It's a bit like the difference between walking outside on a sunny day versus having the sun's light concentrated on your skin using a magnifying glass.
- Laser safety for this type of product is about reducing risk, rather than being able to eliminate it because access is usually required for the applications that it is typically purchased for, so it is not completely safe.
- Be aware that visible laser light is dangerous as well as invisible.
- Be aware that this product may emit invisible laser radiation outside the visible spectrum of 400 nm - 700 nm, which has the added danger that it cannot be seen. If you have such lasers, we advise that you purchase fluorescent cards that assist with observing the presence of the wavelength(s) of invisible laser radiation emitted by this product and that you use them safely.
- In normal use, the Dye Laser converges to a focal point on the microscope stage and then diverges, but if the objective lens is not fitted, then the beam is collimated and is more hazardous.
- It is important to remember to beware reflections from objects such as tools or clips placed close to the laser beam emitted from the microscope objective.
- One of the primary means of protection is protective housing, which as IEC 60825-1 says, *"prevents human access to [hazardous] laser radiation (including errant laser radiation)… except when human access is necessary for the performance of the function(s) of the product."*
- As a user of a product that allows considerable access to hazardous laser radiation to enable it to be used in a wide number of different applications, it is important that you ask yourself how much access to the laser radiation do you need to perform the functions that you require and take any additional precautions that would be wise.
- We strongly recommend that all facilities have an established system for the safe use of lasers as per their national regulations and occupational health and safety legislation. *IEC TR 60285-14 Safety of laser products – Part 14: A User's Guide and the American National Standard for the Safe Use of Lasers (ANSI Z136.1) are standard references for best practice.*
- We also strongly recommend that all facilities have an occupational Laser Safety Officer (LSO) as advised in the aforementioned guidelines, and that the LSO also has a copy of *IEC 60285-1 Safety of laser products – Part 1: Equipment Classification and Requirements.*
- You may consider purchasing laser safety goggles as part of your occupational laser safety protection measures.
- Read the labels on the product and all of the following information on lasers, and ensure that you know the power and wavelengths of the laser radiation emitted by your particular configuration of laser modules and understand the implications of this for you.
- Ensure that the safety interlock system is in good condition and that you test it every day by opening and closing the various interlocked items and checking that the laser emission LEDs operate as expected.
- Ensure that all users of this product have read the laser safety material in this user guide and that they have received adequate training in the general safe use of laser products and specifically in the use of this product.

Laser Product Safety Standards

- This has been designed and manufactured to comply with the international laser product safety standard IEC 60825-1 and the U.S. CDRH Regulation 21CFR § 1040.10 to reduce risk as far as is reasonably practicable.
- In most instances our Customer Support Team install the system according to the same standards, but if there has been an agreement that you should install all or part of the laser product system, then you take responsibility to install this according to the same standards.

Laser Safety Protection Measures

The following protection measures are used in the product to reduce, but not eliminate, the risk of exposure to hazardous laser radiation in accordance with the international product laser safety standard IEC 60825-1 and U.S. CDRH Regulations 21 CFR 1040.10 and 1040.11:

Emission LEDs

See the relevant sections of the laser source's user guide in "Manuals for Components" on page 5

Key Switch

See the relevant sections of the laser source's user guide in "Manuals for Components" on page 5

Protective Housing

- Except at the identified laser apertures at the optical fibre output couplers, or at the ends of the attached optical fibres, or at the microscope stage, or other locations identified as a laser aperture in an attached laser product, the laser radiation within this product has been housed within an aluminium enclosure or inside an optical fibre for your safety.
- Therefore, do not attempt to disassemble this product, including removing optical fibres, or try to gain access to its laser radiation, otherwise you endanger yourself and possibly others.

Safety Interlocks

- Safety interlocks are automatic devices, such as switches or sensors, that are used to prevent human access to laser radiation by stopping the laser product emitting (or in some instances reducing the power to a safe level, but not in this product).
- The optical head has interlocks built into the beam splitter and dye cell blocks so that there is no unnecessary access to potentially hazardous laser radiation when the beam splitter or dye cell is removed.
- It is almost certain that external safety interlocks are attached to the Remote Interlock Connector of this product, e.g. at the eyepiece of a microscope.
- Understand how the interlock system works and do not disconnect or seek to defeat the interlocks as they are there for your protection.
- The HLE comes with an external interlock box called a Laser-Lock. Read the user guide for this accessory product as it is part of the safety design of this product. Do not disconnect or seek to defeat this accessory.

Laser Safety Labelling

Another important protective measure is labelling, which is described in the following sections and you must understand what these mean.

Laser Aperture Locations

- A laser aperture label indicates where laser radiation is emitted as a warning.
- If the point where laser is emitted from your system does not have such a label then contact your occupational laser safety department and/or our Customer Support Team to arrange for a label to be affixed.
- The following label is located on each of the optical fibre output couplers on the unit and on the optical fibres provided with this product by Andor.
- These labels indicate that during installation laser radiation may be emitted from these locations when the optical fibres are disconnected.
- In the most common uses of this product, it will be connected to a larger system that includes a microscope. In such instances, the following label will be fitted beside the microscope objective, or, in the absence of an objective, the socket where the objective is attached.

Microscope Oculars Warning

Although Andor fits eye-piece interlocks to ensure lasers are not emitting when light from the objective is directed away from the camera ports and towards the microscope oculars, nevertheless some microscopes can cause laser "flashes" when port switching, so we warn against viewing the oculars when this is occurring as per the label below, which is fitted on your microscope in the vicinity of your oculars:

Access Panels

- <u>See the relevant sections of the laser source's user guide.</u>

Laser Product Classification Labels with Explanatory Text

- Copies of these labels can be found at the beginning of the Laser Safety Special Warnings section.
- The values on these labels are intended as maximum values for classification purposes based on IEC 60825-1 Condition 3 (using a 7 mm limiting aperture to simulate the eye's pupil at a distance of 100 mm from the laser aperture) taking into account future versions of this product and possible failure scenarios. Typical values of pulse energy are going to be less.
- The values and laser class are based on the latest methodology for classifying pulse lasers in the 2014 edition of IEC 60825-1.
- The wavelength range covers all of the possible wavelengths that can be installed in this unit.

CDRH Certification Label

The Controller's rear panel label includes the words "Complies with 21 CFR 1040.10 and 1040.11 except for conformance with IEC 60825-1 Ed. 3., as described in Laser Notice No. 56, dated May 8, 2019". This means that it complies with the U.S. Federal Regulations for laser products as overseen by the Center for Devices and Radiological Health (CDRH), which is part of the Food and Drug Administration (FDA), by means of IEC 60825-1 Edition 3 as allowed by CDRH Laser Notice No. 56, except for some additional requirements as described in that Notice.

Working with Optical Fibres

- This was installed by our Customer Support Team. For your safety, only they should remove or inspect optical fibres.
- The laser radiation passing through fibres is potentially hazardous, so great care should be taken to avoid exposure to this radiation.
- Optical fibres can be easily damaged by bending or general mishandling, and are especially prone to damage by bending close to the connector.
- Ensure that the minimum bend diameter or radius is never exceeded when handled or coiled.
- The bend diameter is the diameter of the circle created by coiling the fibre, and the bend radius is half of this and created by the "corners" in your fibre layout.
- The FOA state that the minimum bend diameter is 40 times the outer diameter (OD) of the cable when under tension or 20 times when not under tension.
- The NL100/ILE/HLE output fibres are all 3 mm OD, so the minimum bend diameter is 120 mm under tension. We recommend that you aim to have a bend diameter of 150 mm or preferably more.
- The couplers are not designed to withstand pulling of the fibre. If the fibre is pulled the system performance could be compromised, the system may fail, or you may even be exposed to hazardous laser radiation.

Label Symbols

	Laser radiation hazard.
	EU CE Mark by which we indicate that this product meets the requirements all the relevant EU Product Directives that require this mark, including the Low Voltage Directive for safety (as this product in manufactured in Northern Ireland, it does not require the UKCA Mark).
	EU WEEE (Waste Electrical and Electronic Equipment) Mark which indicates that this should not be disposed of in domestic waste but at a suitable recycling site.
	China EPUP (Environmental Protection Use Period) Mark that indicates that this product is expected to last for 20 years approximately before ending-up in the waste and recycling system.

Section 1: Introduction

1.1 MicroPoint 4

Thank you for choosing the Andor MicroPoint System. This user guide contains useful information and advice to ensure optimum performance of your new system.

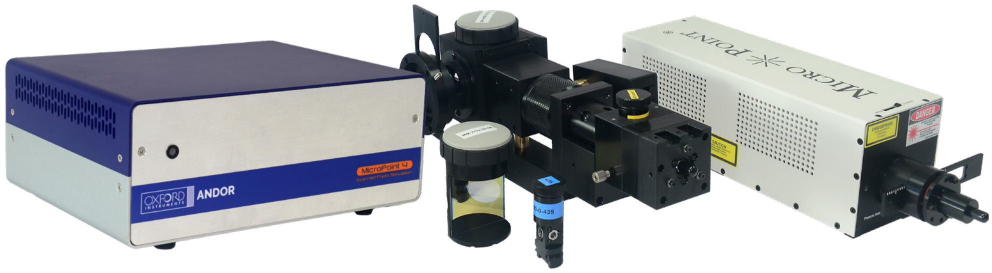


Figure 1: MicroPoint 4

MicroPoint 4® is the 4th generation of the popular photostimulation tool from Andor. Previous generation MicroPoints have been used in hundreds of successful research studies and continue to provide a powerful and flexible tool for ablation, uncaging and, at lower powers, for bleaching and optogenetics.

The new version supports a wider range of applications due to its more sophisticated control hardware, fast galvanometer drives and solid-state lasers.

MicroPoint Nitro uses the classic nitrogen-pumped dye laser system, which supports up to 24 different wavelengths. Dye cells are available across the UV-Visible spectrum from 365 to 656 nm and these provide pulsed illumination up to 15 μJ with 3 - 5 ns pulse width and 20 Hz pulse rate.

MicroPoint Pico introduces an ultra-compact solid-state Nd:YAG laser delivering 1ns pulses with a repetition rate of up to 5 kHz, at user selected wavelengths of 355 or 532 nm. Pulse energies up to 2 and 10 μJ respectively allow fast, progressive microsurgery, ablation, uncaging and DNA damage. When tightly integrated with fast galvos and smart control, Pico delivers leading edge performance with increased precision and productivity. Pico is available on **galvanometer** models only.

MicroPoint 4 adds optional support for Continuous Wave (CW) lasers by means of a fibre spot adapter (FSA). CW lasers (such as those used in Andor's ILE or HLE) are coupled to the FSA using a multimode optical fibre. CW lasers are preferred for FRAP (Fluorescence Recovery After Photobleaching), photoactivation and photoswitching. CW lasers are available for both manual and galvanometer models.

MicroPoint 4 Nitro and Pico models can be combined with CW lasers. Pico and FSA are combined in a dichroic block by virtue of non-overlapping wavelengths. The laser source and wavelength can be selected through a software control protocol. While switching between Nitro and FSA requires exchange of a dye cell but takes only a few minutes to complete.

MicroPoint galvanometer and manual versions have the following capabilities and user interface:

- The **manual** versions deliver a focused spot which is easily positioned in the field of view with a single 2-axis adjuster. Nitro and FSA lasers are compatible. Once set, the microscope stage positions the specimen for laser targeting. Control of laser intensity, trigger and pulse properties is set via LCD touch screen. No computer is required, and triggering is manual via foot pedal or TTL signals.
- The **galvanometer** model is computer-controlled via USB and Andor iQ software. A documented software development kit (SDK) is also available, or users can use the iQ-virtual camera to easily integrate with 3rd party software. Nitro, Pico and FSA lasers are all compatible. The software directs the instrument to scan in lines, rectangles, ellipses and freehand regions: all with user-defined scan densities and laser wavelength, frequency and intensity settings.

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

USA

Andor Technology
300 Baker Avenue
Suite # 150
Concord
MA 01742
USA
Tel. +1 (860) 290-9211
Fax. +1 (860) 290-9566

Asia-Pacific

Andor Technology (Japan)
5F IS Building
3-32-42 Higashi-Shinagawa
Tokyo 140-0002
Japan
Tel: +81 3 6732 8968
Fax: +81 3 6732 8939

China

Andor Technology (China)
Haitong Times Business Center,
Building B2 West,
No.11 West Third Ring North Road,
Haidian District,
Beijing,
100089
China
Tel: +86 (0) 10 5884 7900
Fax. +86 (0) 10 5884 7901

* The latest contact details for your local representative can be found on the Contact and Support page of our website.

1.3 Disclaimer

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PLEASE NOTE, AI TRANSLATIONS OF THIS USER MANUAL MAY RESULT IN INCORRECT INFORMATION. IN THE EVENT OF A CONFLICT WITH A FOREIGN LANGUAGE TRANSLATION, ANDOR'S ENGLISH TRANSLATION WILL PREVAIL.

1.4 Copyright and Protective Notices

The publication of information in this documentation does not imply freedom from any patent or proprietary right of Andor Technology Ltd. or any third party.

1.5 Trademarks and Patent Information

Andor, the Andor logo, MicroPoint 4 and Fusion are trademarks of Andor Technology Ltd. Andor Technology Ltd is an Oxford Instruments company. All other marks are property of their owners.

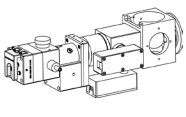
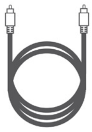
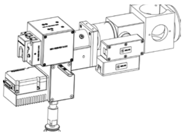
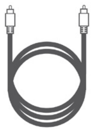
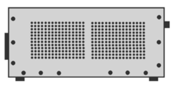
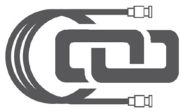
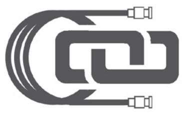
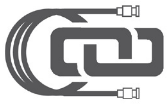
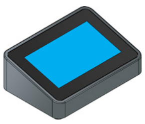
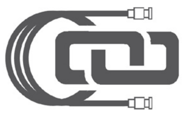
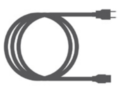
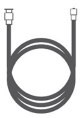
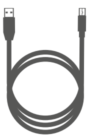
Manufacturers Information

Andor Technology Ltd., Belfast, BT12 7AL, UK.

1.6 Supplied Components MicroPoint 4

Some of the components of the MicroPoint 4 are covered in other manuals. These are the ILE and HLE laser engines (optional), and the Laser-Lock (interlock box). Please refer to these manuals online for operation and safety information. The standard components supplied with MicroPoint 4 are shown in Table 1.

Table 1: Standard components supplied with MicroPoint 4.

		Quantity			Quantity
	Optical Head (Nitro galvo model shown with FSA)	1		Fibre Optic for NL100 (option)	1
	Optical Head (Pico galvo model with FSA) - option	1		Fibre Optic for ILE/HLE (option)	1
	NL100 Laser (option)	1		NL100 Trigger Cable (BNC)	1
	ILE or HLE Laser (option)	1		HLE Trigger Cable (BNC)	1
	Micropoint 4 Controller	1		NL100 Interlock Cable.	1
	LCD Touchscreen Remote Controller (manual version)	1		Interlock Cable Kit (dye cell, mirror block etc)	1
	Country Specific Power cable (one for controller and one for laser)	2		HLE Interlock Cable	1
	Power Supply Unit (one for Controller and one for NL100)	2		Keys for the NL100 Nitrogen Laser	1
	USB Cable* (galvo models only)	1		Hex Key T wrench	1
	User Guide (in electronic format)	1			

*USB 3.0 connection. This may also be referred to as USB 3.1 (Gen 1). Andor provide a USB 3.0 (Standard-A to Standard-B) cable and recommend that this is used to ensure optimum performance. Please note USB 3.0, USB 3.1 (Gen 1) and USB 3.2 Gen 1x1 are equivalent.

1.7 Accessories

A range of optional accessories are available to order, please contact your local sales representative for further information.

1.7.1 Core Unit, Laser Sources and Adapters

This table shows order codes for the core units - galvo and manual options. For full table see the Specification Sheet.

Table 2: Core Units Part Numbers

MicroPoint 4 Galvo	Select Core System based on your Microscope			
	Zeiss Axio, Leica DM, All Nikon models	Leica DMI8, Evident/Olympus IX/BX	Zeiss Axiovert 200	Evident/Olympus: BX51/WI model
MicroPoint 4 Galvo with Nitro Dye Laser	**MP-4203-NGO**	**MP-4204-NGO**	**MP-4205-NGO**	**MP-4206-NGO**
COMING SOON MicroPoint 4 Galvo with Pico Laser	**MP-4203-PGO**	**MP-4204-PGO**	**MP-4205-PGO**	**MP-4206-PGO**
FSA	**MP-4210-FSA-S**			

MicroPoint 4 Manual	Select Core System based on your Microscope			
	Zeiss Axio, Leica DM, All Nikon models	Leica DMI8, Evident/Olympus IX/BX	Zeiss Axiovert 200	Evident/Olympus: BX51/WI model
MicroPoint 4 Manual with Nitro Dye Laser	**MP-4203-NMA**	**MP-4204-NMA**	**MP-4205-NMA**	**MP-4206-NMA**
FSA	**MP-4210-FSA-S**			

Step 1.	Choose your control interface, laser and microscope. Select one of these or none if FSA only	
Core Unit	Galvo for Nitro dye laser and/or FSA - see top table	**MP-4203-NGO to MP-4206-NGO**
	COMING SOON Galvo for Pico laser - see top table	**MP-4203-PGO to MP-4206-PGO**
	Manual for Nitro dye laser and/or FSA - see table above	**MP-4203-NMA to MP-4206-NMA**
Step 2.	**Add optional CW laser if required to any MP-420X model**	
FSA and CW lasers	FSA - supports CW laser input - optical fibre included	**MP-4210-FSA-S**
	See ILE and HLE Specification Sheet to order CW lasers	
Step 3.	**Select one pulsed laser or none if FSA only**	
Pulsed Laser	Nitro for dye laser Galvo model	**MP-N2CE-PSIA**
	Pico laser for Galvo model	**MP-NDYAG-1NS**

1.7.2 Laser Dyes

This table shows part numbers and key specifications for the different laser dyes available.

Table 3: Laser Dye Part Numbers

MicroPoint Laser Dyes		
Dye Part Number	**Centre (±1) Wavelength/nm**	**Efficiency (Relative to 435nm)/%**
MP-27-365-DYE	365	66
MP-27-388-DYE	388	46
MP-27-390-DYE	390	60
MP-27-404-DYE	404	38
MP-27-419-DYE	419	40
MP-27-422-DYE	422	60
MP-27-435-DYE	435	100
MP-27-471-DYE	471	70
MP-27-481-DYE	481	64
MP-27-514-DYE	514	50
MP-27-521-DYE	521	76
MP-27-539-DYE	539	70
MP-27-543-DYE	543	30
MP-27-551-DYE	551	84
MP-27-576-DYE	576	54
MP-27-582-DYE	582	69
MP-27-590-DYE	590	73
MP-27-593-DYE	593	52
MP-27-613-DYE	613	42
MP-27-622-DYE	622	56
MP-27-626-DYE	626	71
MP-27-651-DYE	651	52
MP-27-656-DYE	656	52

1.7.3 MicroPoint Laser and Microscope Interlock Components

MicroPoint lasers are all supplied with interlock systems to ensure safety of the user and to meet standards such as CDRH and IEC-60825. We list the parts and assemblies currently supported to ensure installation is compliant across the many microscope models and configurations. If you have an instrument that is not listed here, we will be required to create a new configuration. It is essential that you do not disable or otherwise interfere with the proper operation of the interlock system. The resulting hazards can be severe and lead to serious damage to eyes and body parts that come into contact with the intense laser beams used in these products.

The Food and Drug Administration's (FDA) Center for Devices and Radiological Health (CDRH) regulate the manufacture of radiation emitting electronic products. Andor products, including all MicroPoint 4 models comply with FDA regulations contained in Title 21 Code of Federal Regulations Parts 1000-1299 (21 CFR 1000- 1299). According to section 531 of the FD&C Act. The requirements specific to laser products are referred to as the Federal Laser Product Performance Standard or "FLPPS".
The International Electrotechnical Commission (IEC) Standards headquartered in Geneva, Switzerland, is the organization that prepares and publishes international Standards for all electrical, electronic and related technologies including laser products. Andor MicroPoint products are complaint with IEC 60825-1:2014 regulations.
The following table describes the part codes, microscopes and primary function of the interlock components.
Note: when more than one laser source is used in an instrument, an interlock combiner is required.

Table 4: **Interlock Components. Andor will choose which of these you need from information you supply.**

Interlock Components	
Product Codes	**Description**
IL-BX53	Olympus BX-53 Interlock
IL-BX53-ROD-2POS	BX53 TriNoc Slider Rod M3 2Pos Short
IL-BX53-ROD-UTTR	BX53 TriNoc Slider Rod M4 3Pos U-TTR-2
IL-COMB	Interlock Combiner Kit
IL-COMB-CL4	Laser-Lock Class 4 Interlock Combiner
IL-DF	Dragonfly Replacement Interlock Cable
IL-DM6	Leica DM6 Interlock Adaptor Kit
IL-DMI8	Leica DMi8 Interlock Kit
IL-DMI8-COMBO	Interlock kit with UB shutter Leica DMI8
IL-DSK	Diskovery Interlock Cable
IL-EX1M	Modular Interlock 1 m Extension
IL-EX30	Modular Interlock 30 cm Extension
IL-EX60	Modular Interlock 60 cm Extension
IL-ILE	ILE Primary Interlock Cable Kit
IL-ILE-2	ILE Primary/Secondary Interlock Cable
IL-IMUX	Interlock Mux Kit MODULAR
IL-INV	Generic Inv Microscope Interlock Kit
IL-IX71	Olympus IX71 Interlock Kit
IL-IX81	Olympus IX81 Interlock Kit
IL-IX83	Olympus IX3 Interlock Kit (IX73 or IX83)
IL-LDMI	Leica DMi3/4/5/6000 Interlock Kit
IL-LLM5-FLOCK	Use IL-LMM5-FLOCK instead
IL-LLOCK	Laser-Lock Product Interlock Combiner
IL-LMM5-FLOCK	Lmm5 Fibre Lock Upgrade Kit

IL-MEBS	Mosaic Epi-port Beam Splitter Interlock
IL-MIDU	Mosaic Infinity Dual-Laser Interlock Ext
IL-MINF	Mosaic Infinity Interlock Cable
IL-MMAR	Mosaic Argon Laser Interlock Replacement
IL-MMBD	Mosaic Body Interlock Replacement Kit
IL-MMDU	Mosaic Duet Body Interlock Replacement
IL-MMLD	Mosaic Laser Diode Interlock Replacement
IL-MOS-DUET-UPG	Historic Mosaic 3 Interlock Upgrade Kit
IL-MOS-UPG	Historic Mosaic 3 Interlock Upgrade Kit
IL-MPNC	MicroPoint Non-CE Interlock MODULAR
IL-MPNL	MicroPoint NL-100 Interlock Replacement
IL-NC2+	Nikon C2+ Interlock Adaptor
IL-NCA1	Nikon A1* Confocal Interlock Adapt (Part O)
IL-NFN1	Nikon FN1 LV-TI3 Interlock Kit
IL-NNIU	Nikon Ni-U Interlock Adaptor Kit
IL-NTI2	Nikon Ti2 Interlock Kit
IL-NTI2	Nikon Ti-E Interlock Kit
IL-NTIU	Nikon Ti-U Interlock Kit
IL-PCUB	PCUB Upgrade Kit for AOTF Soft Interlock
IL-RIC	Remote Interlock Connector (RIC)
IL-RVXD	ALC/PCU Interlock Cable
IL-TEST-KIT	Connections for testing Andor Interlocks
IL-UPR	Generic Upright Microscope Interlock Kit
IL-WDB	WDb (CSU-W1 Borealis) Interlock Cable
IL-ZAXI	Zeiss Axio Imager Interlock Adaptor

NOTE: MicroPoint laser interlock parts may require use of a combiner when used with other laser products

1.7.4 CW Laser Sources for MicroPoint 4 Fibre Spot Adapter

The fibre spot adapter provides an optical fibre input for continuous wave (CW) lasers, delivering a focused spot to the specimen plane. In combination with the new smart controller, the FSA extends MicroPoint 4 capabilities for scanned multi-region **FRAP, photoconversion and photoactivation.**

When your specimen requires sustained absorption or more gentle treatment than the energetic pulsed lasers, CW lasers can provide the right tool for the job.

You can use Andor's integrated laser engines, ILE and HLE (Figure 2), or supply your own laser source: subject to optical compatibility and safety requirements. The FSA is supplied with a multi-mode optical fibre for ILE and HLE. For other lasers, a 25 or 50 µm multimode fibre is available.
For more information see the MicroPoint 4 or ILE/HLE specification sheets or ask your local Andor representative.

Figure 2: Andor's Integrated Laser Engine (ILE) (Left) and High-Power Laser Engine (HLE) (Right) with optional millisecond switching to multi-port outputs. The laser engines are compatible with MicroPoint 4 using the new fibre spot adapter (FSA).

Table 5: Some important properties of ILE and HLE integrated laser engines, compatible with MicroPoint 4.

Properties	ILE - up to 8 lines	HLE - up to 10 lines
Wavelengths, nm	405, 445, 488, 514, 561, 594, 640, 685, 730, 785	405, 445, 488, 515, 560, 594, 640, 685, 730, 780
Number of outputs	1, 2, 3; ~3 msec switching time	1, 2, 3; ~7 msec switching time
Control Interface	USB	USB
Borealis™ Compatible	Yes	Yes
Direct Control	TTL/Analog	TTL
Power Levels	50 - 200 mW	300 - 2400 mW
Dynamic Range	1:500	1:50,000

1.7.5 Epifluorescence and Optogenetic Light Sources for MicroPoint

When required, Andor supplies LED epi-fluorescence light sources as part of the sub-system. Andor works with CoolLED to qualify and supply suitable LED models. pE-300 and pE-800 (Figure 3) are the primary sources. These devices are controlled via USB serial communications and TTL for triggered operation. LEDs are efficient and long lasting (20,000 hr) and are excellent low noise optical sources for fluorescence imaging and optogenetic stimulation, where required power densities for stimulation are low. We recommend liquid light guide (LLG) coupling to minimise any vibration-coupling, or they can be directly coupled to microscope flanges.

The table shows the key characteristics of the two models. For more information refer to the CoolLED user manuals or contact your Andor representative.

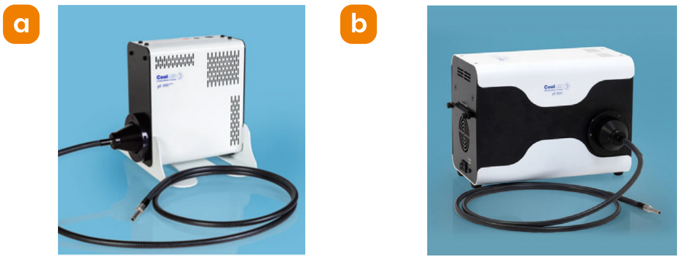


Figure 3: CoolLED LED sources for fluorescence microscopy supplied by Andor. a) pE300 3-line LED with LLG coupling. b) pE800 8-line LED source with LLG coupling.

Table 6: Key features of pE300 and pE800 LED light sources for epi-fluorescence and optogenetics applications.

Properties	pE300	pE800
Wavelengths, nm	365 or 405, 450, 550 - 650	365, 400, 435, 470, 500, 550, 580, 635, 740
Excitation Filter Option	pE-300 Ultra model only	8 channel
Control Interface	USB	USB
LLG Collimator	PE-10400-40E	PE-10400-40E
TTL Control	Yes	Yes
Manual Control Pod	Yes	Optional

1.7.6 Beam Splitter Cubes for Combining Photostimulation and Epifluorescence Light Sources

In most microscope systems using MicroPoint there will be multiple illumination sources which allow the user to observe the specimen as well as apply targeted photostimulation from MicroPoint. The epifluorescence light source will be coupled to the MicroPoint with a flange and sometimes via a liquid light guide (LLG). To combine the illumination beams in the MicroPoint we use custom beam splitter plugs (BSP).

A **beam splitter plug (BSP)** splits or combines the incident beam(s) into 2 components – the transmitted beam (T) and the reflected beam (R) at 90 degrees. Different beam splitter plugs are available with different percentages of T and R, and with different wavelengths for the transmitted and reflected light. See Table 7.

A block diagram highlighting the beam splitter plug (BSP) is shown in Figure 4. The BSPs are large, easy to handle and exchange if needed, with an integrated laser safety interlock which stops the MicroPoint laser from firing when no BSP is in the BS block to prevent unnecessary access to hazardous laser radiation as required by IEC 60825-1.

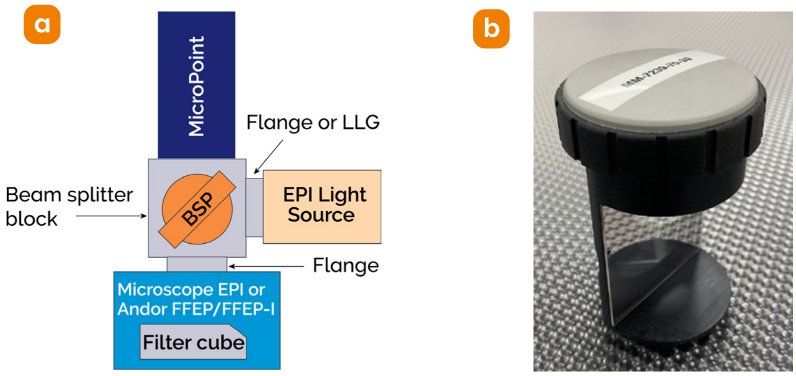


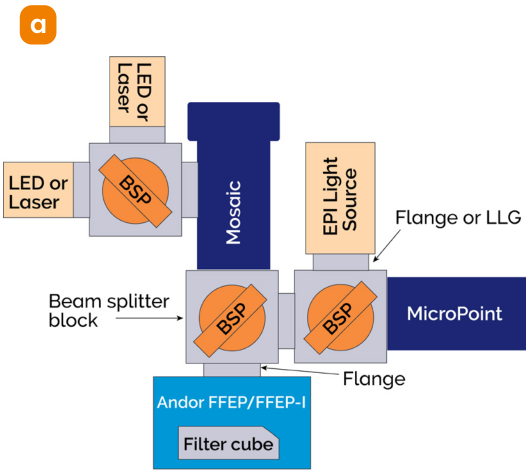
Figure 4: a) Block diagram of the MicroPoint showing Beam Splitter Plug (BSP) which allow beam combination for Epi and Photostimulation sources. b) Photograph of BSP which combines sources and completes the laser safety interlock. Note the Epi source can be connected to either side of the BS block to optimise the footprint for microscope coupling.

Popular BSP	Purpose
MM-7246-BSP-425SP	365 or 435 dye laser, EPI illumination above 450 nm
MM-7239-50-50	50% any dye laser, 50% EPI all wavelengths

The BSP filters can be broad band splitters designed to operate over a wide range of wavelengths in the UV-Vis part of the spectrum (350 - 750 nm) or they can be wavelength selective, including: short wave pass (SP), band-pass (BP), band-reflect (Notch) or long pass (LP) dichroic filters. All BSP accessories are presented in the optical path at 45 degrees to the optical axes as shown in Figure 4 and Figure 5.

Andor provides a wide range of these BSP to support combined imaging and photostimulation as shown in Table 7.

In addition to BSPs which allow combination with epifluorescence sources, MicroPoint 4 can also be combined with Andor's patented Mosaic DMD device and with laser-based confocal microscopes, such as Andor's Dragonfly. Mosaic is combined with BSPs as shown in Figure 5. The range of BSPs allows Mosaic, MicroPoint and EPI fluorescence sources to be combined, for ultimate flexibility.



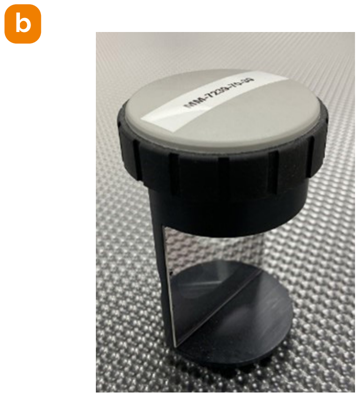


Figure 5: MicroPoint coupled to Mosaic AND Epi fluorescence sources. Mosaic is a patented DMD based device for patterned illumination, supporting lasers and LEDs for FRAP, photo-conversion, activation and optogenetics applications. Highlighted in orange are the BSPs and where they provide beam-combining duties to deliver extremely flexible solutions for complex experimentation.

Table 7: Beam Splitter options available for MicroPoint and Mosaic. Select BSPs to support laser and Epi wavelengths for imaging and photostimulation requirements.

Beam Splitter Plugs		
Part Number	**Description**	**Notes**
MM-7247-BSP-100	Beam Splitter Plug 100R/0T	R > 90% 350 - 700 nm
MM-7239-30-70	Beam Splitter Plug 30R/70T	R~30%; T~70% 350 - 700 nm
MM-7239-50-50	Beam Splitter Plug 50/50	R~50%; T~50% 350 - 700 nm
MM-7239-70-30	Beam Splitter Plug 70R/30T	R~70%; T~30% 350 - 700 nm
MM-7240-BSP-BLK	Beam Splitter Plug Blank 1.1 mm	Open - custom use or interlock only
MM-7246-2-BSP-CFP	Beam Splitter Plug Reflect 405 Laser	R 400 - 410; T 430 - 750 nm
MM-7246-3-BSP-405	Beam Splitter Plug Reflect 390-410 Laser	R 390 - 415; T 425 - 800 nm
MM-7246-4-BSP-440	Beam Splitter Plug Transmit 400-435 Laser	T > 70%: 400 - 435, R 470 - 700 nm
MM-7246-5-BSP-405	Beam Splitter Plug Transmit 405 Laser/LED	T 395 - 415; R 430 - 700 nm
MM-7246-BSP-385SP	Beam Splitter Plug Transmit 365 Laser/LED	T 350 - 385; R 400 -7 50 nm
MM-7246-BSP-425SP	Beam Splitter Plug + 425SP DM	R 350 - 415; T 430 - 850 nm
MM-7246-BSP-470LP	Beam Splitter Plug + 470LP DM	R 350 - 455; T 475 - 700 nm
MM-7246-BSP-475/50	Beam Splitter Plug 475/50 bandpass DM	R 350 - 430; T 440 - 500; R 515 - 750 nm
MM-7246-BSP-520SP	Beam Splitter Plug + 520SP DM.	T 350 - 485; R 520 - 630 nm
MM-7246-BSP-613LP	Beam Splitter Plug Reflector	R 558 - 598; 620 - 850 nm
MM-7246-BSP-700SP	Beam Splitter Plug 700 SP.	T 390 - 675; R 715 - 850 nm
MM-7246-BSP-BLK	Beam Splitter Plug Blank 2.5 mm	Open - custom use or interlock only

Note: specification values indicate wavelengths where R >= 90%; T >= 90%, unless otherwise annotated.

1.7.7 Microscope and MicroPoint Flanges

Figure 4 and Figure 5 show MicroPoint coupled to the microscope via a flange. When using the original microscope Epi port, the flanges must match the original manufacturer and model. But if using Andor FFEP (flat field epi port - Section 1.9), the Andor internal standard specifies Zeiss 38 mm flanges. The table defines the flanges available for coupling to Leica, Nikon, Evident Olympus and Zeiss microscope epi ports. Note that if the user wishes to re-use the epifluorescence light source, which also has a flange, then a female flange must be provided on the MicroPoint lamphouse block to allow connection. Be sure to match male and female flanges when ordering.

Figure 6: a) Zeiss and b) Nikon Microscope Flanges

Table 8: Flanges to support MicroPoint coupling to microscope epi ports and lamp houses. MicroPoint uses Zeiss 38 mm flanges as its internal coupling standard.

Part Number	Description	Part Number	Description
MM-7235-F-NKF	Nikon HMX Female Flange	**MM-7237-LMS**	38 mm diam Leica 50 mm Spacer
MM-7235-M-NKF	Nikon HMX Male Flange	**MM-7237-M-LCF**	Leica Flange Male
MM-7235-NKF-HMX	38 mm Nikon HMX Female Flange	**MM-7238-F-SP-ZSF**	38 mm Zeiss Female Flange MicroPoint to Mosaic
MM-7236-F-OLF	Evident Olympus BX/IX Female Flange	**MM-7238-F-ZSF**	Zeiss Flange Female
MM-7236-M-OLF	Evident Olympus BX/IX Male Flange	**MM-7238-M-SP-Z50**	Mosaic/MicroPoint LH Zeiss Male with Spacer 50 mm
MM-7236-OLF	38 mm Evident Olympus Flange Set	**MM-7238-M-SP-ZAR**	Zeiss Gender Adapter for Mosaic
MM-7237-F-LCF	Leica Female Flange	**MM-7238-M-ZSF**	Zeiss Flange Male
MM-7237-LCF	Leica Lamphouse Flange Set	**MM-7238-ZSF**	Zeiss Axio Lamphouse Flange Set
MM-7237-LCF-DML	Leica LH Flange Set + Spacers 50 & 100 mm		

1.7.8 Microscope Optical Coupling with Andor Flat Field Epi Ports (FFEP)

We use the Andor FFEPs when building around new microscopes to ensure best compatibility. When retrofitting to existing systems we review instrument configuration and re-use the microscopes existing equipment. However when MicroPoint is supplied with Mosaic 3, we must use Andor FFEP to optimise performance. FFEPs are designed for individual microscopes as shown in the table. Note that FFEP models are used with Mosaic 3 small format models, while FFEP-I models are used with Mosaic large format. MicroPoint can be adapted to either FFEP or FFEP-I. Figure 7 shows examples of FFEP-I (with iris) for Zeiss and Olympus microscopes, the table shows the adapters available for many microscope models.

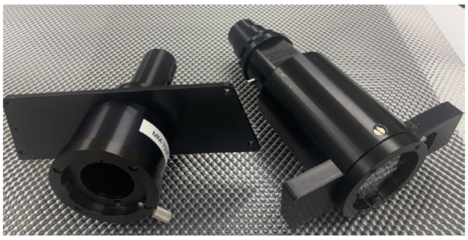


Figure 7: Examples of flat field epi ports (FFEP) and FFEP-I for Zeiss and Olympus inverted microscopes. Products are available for all the scopes listed in the table below.

Of special note: **Leica DM6B and DM6-FS** microscopes use diffusers in the epi-fluorescence axis to improve uniformity. These are not compatible with MicroPoint 4. The diffuser must therefore be removed from the axis by a service engineer. In some more recent developments, both Leica and Nikon has changed their epi-fluorescence axis couplings and we prefer to replace the manufacturer model with our own FFEPs optimised for use with MicroPoint and Mosaic.

Table 9: Andor Flat Field Epi Ports are used with MicroPoint with new microscopes and with Mosaic. Select the model suitable for the microscope.

Part Number	Description	Long Description
MM-7310-BX51-FFEP	BX51/61 FFEP	Flat Field Epi Port BX51/61
MM-7310-BX51-FFEP-I	BX51/61WI FFEP	Flat Field Epi Port BX51/61 WI
MM-7310-D1-FFEP	Mosaic 06 AxioD1 Epi	Mosaic 06 Flat Field Epi Axio Examine D1
MM-7310-D1-FFEP-I	Mos-02 Axio D1 Epi	Mosaic 02 Flat Field Epi Port Axio Examiner D1
MM-7310-DMI-FFEP	MOS-06 Leica DMI Epi	Mosaic 06 Flat Field Epi Port Leica DMI
MM-7310-DMI-FFEP-I	MOS-06 Leica DMI Epi	Mosaic 06 Flat Field Epi Port Leica DMI
MM-7310-DMI8-FFEP	Mosaic 06 DMi8 Epi	Mosaic 06 Adapter DMi8 Rear Infinity Port
MM-7310-DMI8-FFEP-I	Mosaic DMi8 Rear Epi	Mosaic 02 Adapter DMi8 Rear Infinity Port
MM-7310-IX3-FFEP	Flat Field Epi Port	Flat Field Epi Port IX3 / 8206
MM-7310-IX70-FFEP	IX71/81 FFEP	Flat Field Epi Port IX70/71/81
MM-7310-IX70-FFEP-I	IX71FFEP	Flat Field Epi Port IX70
MM-7310-IX83-FFEP-1	DO NOT USE	Flat Field EPI Port IX83 / 8601/2
MM-7310-IX83-FFEP-I	Flat Field EPI Port	Flat Field EPI Port IX3 / 8202
MM-7310-M1-FFEP	Flat Field EPI Port	Flat Field Epi Port for Zeiss Imager M1
MM-7310-M1-FFEP-I	Flat Field EPI Port	Flat Field Epi Port for Zeiss Imager M1
MM-7310-NIFNL-FFEP-1	Mosaic 1 - NiE Adapt	Mosaic 1 Adapter to Nikon NiE Lower Tier
MM-7310-OBS-FFEP	FFEP Axio Observer	Flat Field Epi Port Axio Observer
MM-7310-OBS-FFEP-I	FFEP Axio Observer	Flat Field Epi Port Axio Observer

MM-7310-TE2K-FFEP	FFEP TE2000	Flat Field Epi Port TE2000
MM-7310-TE2K-FFEP-I	FFEP TE2000	Flat Field Epi Port TE2000
MM-7310-TI-FFEP	FFEP Nikon Ti	Flat Field Epi Port Nikon Ti/Ti2
MM-7310-TI-FFEP-I	FFEP Nikon Ti	Flat Field Epi Port Nikon Ti with Iris
MM-7310-ZSAV-LENS	FFEP Axiovert200	Flat Field Epi Port Axiovert 200
MM-7310-ZSAX-FFEP	Mosaic EPI Axioskop	Mosaic Epi Port for Zeiss Axioskop

1.7.9 Filter Cubes Combining Photostimulation with Microscope Systems

The filter cubes are presented in the table overleaf. They are used to combine the Epi and Photostimulation beams with the microscope imaging port(s). This includes cameras for side port imaging and also confocal imaging devices such as Dragonfly. Note that Third Party devices can be supported in some cases.

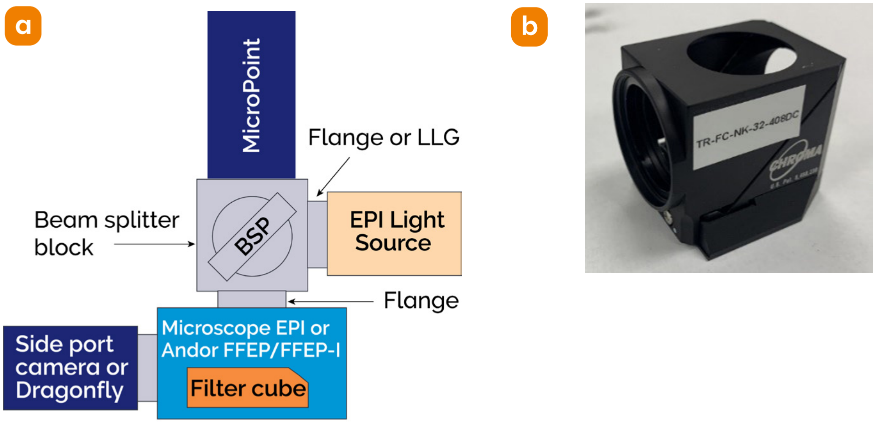


Figure 8: MicroPoint 4 with microscope filter cube highlighted in orange.

Popular Scope Cube	Purpose
TR-FC-XX-YY-460DC	365 or 435 dye laser, side port excitation & emission ≥ 470 nm
TR-FC-XX-YY-7030	30% any dye laser, 70% side port excitation & emission any wavelengths

Table 10: Microscope filter cubes allow combined imaging through side port and rear port photostimulation. Side port configurations range from a camera to confocal imaging solutions. In these cases, the generic part codes indicate the spectral character of the dichroic used. To adapt for different microscope make and models, substitute the microscope-specific code e.g. LC-51 for Leica DMi8 giving TR-FC-LC-51-408DC – a dichroic supporting MicroPoint 355 - 405 nm photostimulation. Note these filters and cubes are laser quality and pre-aligned to ensure the necessary optical performance.

Filter Cubes			
Generic Part Number	**Notes (nm)**	**Code**	**Description**
TR-FC-XX-YY-375DC	375 LP	XX-YY	Substitute with Scope Specific
TR-FC-XX-YY-400-532R	R 400-450, R 532	LC-24	Leica DM/DMI Laser TIRF/PS Cube
TR-FC-XX-YY-408DC	R 350-408	LC-51	Leica DMi8 Laser TIRF/PS Cube
TR-FC-XX-YY-460DC	R 400-450	NK-32	Nikon Ti/Ti2 Laser TIRF/PS
TR-FC-XX-YY-488DC	480 LP	OL-41	Olympus BX2 Laser TIRF/PS
TR-FC-XX-YY-488NF	488 Notch	OL-44	Olympus 25 mm BX3/IX3 Laser TIRF/PS
TR-FC-XX-YY-505DC	505 LP	ZS-42	Zeiss Axio Laser TIRF/PS
TR-FC-XX-YY-505FS	505 Filter set		
TR-FC-XX-YY-532DC	532 LP		
TR-FC-XX-YY-550-NDC	550 Notch		
TR-FC-XX-YY-561FS	561 Filter set		
TR-FC-XX-YY-561NF	561 Notch		
TR-FC-XX-YY-620DC	620 LP		
TR-FC-XX-YY-7030	T 70/R 30 380 - 800		
TR-FC-XX-YY-GFPMCH			
TR-FC-XX-YY-MIRR	~R 100 380 - 800		
TR-FC-XX-YY-TRPLDC			

Section 2: Product Overview

2.1 Hardware Description

This section provides an overview of the general principles of operation and a description of the hardware of MicroPoint 4.

Figure 9: a) MicroPoint 4 **Galvo Nitro** components and b) MicroPoint 4 **Manual Nitro** components

MicroPoint 4 Nitro uses a pulsed UV nitrogen laser to pump fluorescent laser dyes loaded into a small optical resonator cell of size 5 mm x 5 mm x 5 mm to produce pulsed beams at different wavelengths. The laser dye sets the wavelength and the resonator produces energetic laser pulses with an average power of 0.3 mW in intensity and peak of around 7 kW with a duration of 3 - 5 ns.

MicroPoint 4 Pico exploits an Nd:YAG laser with 2X and 3X frequency multiplication to deliver pulses at either 355 or 532 nm (user selectable). Average power is 4 and 20 mW respectively with a peak power of 2 and 10 kW, pulse duration of ~1 ns, and repetition rate of up to 5 kHz.

There is also the facility to use the Andor ILE Class 3B laser with a power range 50 - 150 mW, or the new higher-powered HLE Class 4 laser, power range 400 - 2500 mW. These are CW lasers and connect through an optional fibre spot adaptor (FSA) instead of the dye cell. The FSA can be attached to both manual and galvo models in MicroPoint 4.

The laser spot can be steered or scanned using optional X-Y galvo beam optics. Power is controlled using a motorised attenuator in the MicroPoint optical head. **MicroPoint 4 Galvo models** are pc-controlled while the **MicroPoint 4 Manual models** are operated via an LCD touch screen.

The product consists of the following modules:

- the pulsed laser source,
- an optical head containing a dye cell, beam conditioning lenses and galvo deflectors (optional). Integrated or high power laser sources (ILE or HLE) can be used via the FSA.
- the smart microcontroller powered by an external power supply.
- a touch screen remote controller for the Manual version or PC-control (Galvo version).

There is a fibre optic cable from the laser to the MicroPoint dye cell, except in the case of the pico laser which is mounted on the optical head.

2.1.1 Intended Use

The MicroPoint 4 can be used in life sciences for ablation, uncaging, DNA damage and fluorophore photobleaching, photoactivation and Fluorescence Recovery After Photobleaching (FRAP). MicroPoint 4 can also be used for materials processing, for example, marking semiconductor wafers.

Using the HLE or ILE, the laser source can be shared for fluorescence imaging applications and photostimulation by providing a second fibre output from the laser engine. In these cases continuous wave illumination is delivered via the FSA, which may be preferred for bleaching and optogenetics, where lower peak power is preferred.

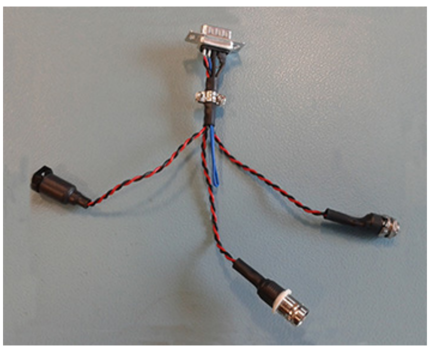
When coupled to the new fast galvos of MicroPoint 4, Pico provides a high speed tool for ablation, microsurgery, uncaging and DNA damage applications.

2.1.2 NL100 Laser Rear Panel

First if we look at the back of the Nitro NL100 laser, the key goes into the slot in the bottom left hand corner.
The pulse rate can be set by turning the RATE knob at the top left.
Three electrical cables connect from the panel.

Figure 10: NL100 laser rear panel

1



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3

Figure 11: Three electrical cables connect from the panel. 1 is the Interlock connector, 2 is the DC In connector which is 24 V 2A, 3 is a BNC connector for Laser Trigger In.

2.2 Electrical Connections, Optical Connections and Interlocks

2.2.1 Electrical Connections

For connection positions on the back of the controller box see "2.2.5 Back Panel on MicroPoint 4 Controller" on page 39.
Only galvo models are PC-controlled. These may be either NL100 Nitro laser or ILE/HLE versions.

2.2.1.1 Nitrogen Laser NL100 Configuration, PC-Controlled, Galvo Version

The back panel of the MicroPoint 4 controller is shown with the relevant connections.

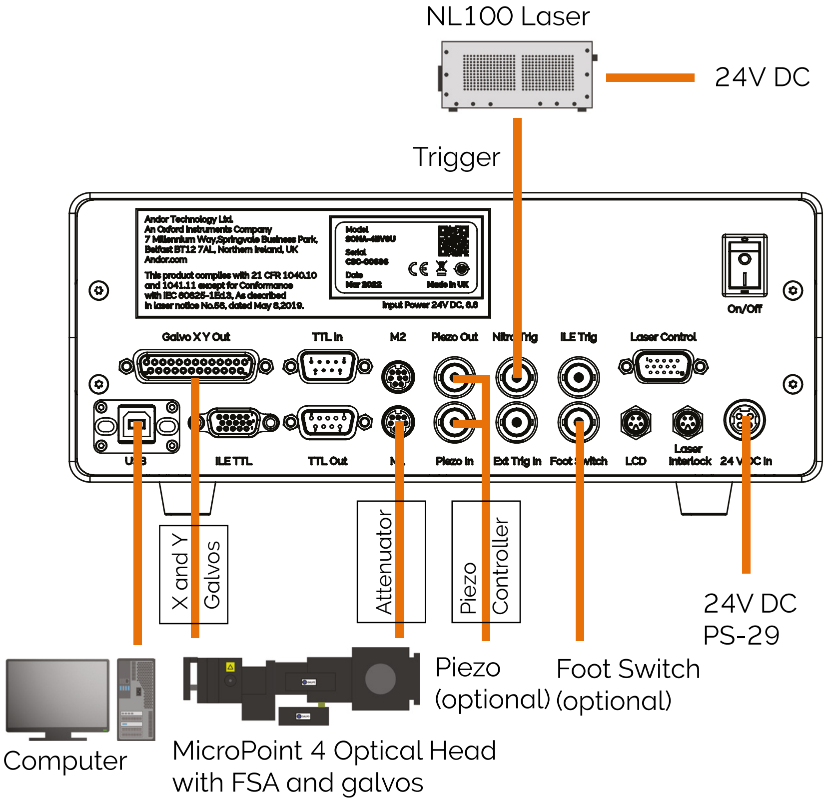


Figure 12: Electrical Connections NL100 PC Galvo version see "Back Panel on MicroPoint 4 Controller" on page 39

2.2.1.2 ILE/HLE Laser Configuration, PC-Controlled, Galvo Version

The schematic shows the back panel of the MicroPoint 4 controller with the relevant connections.

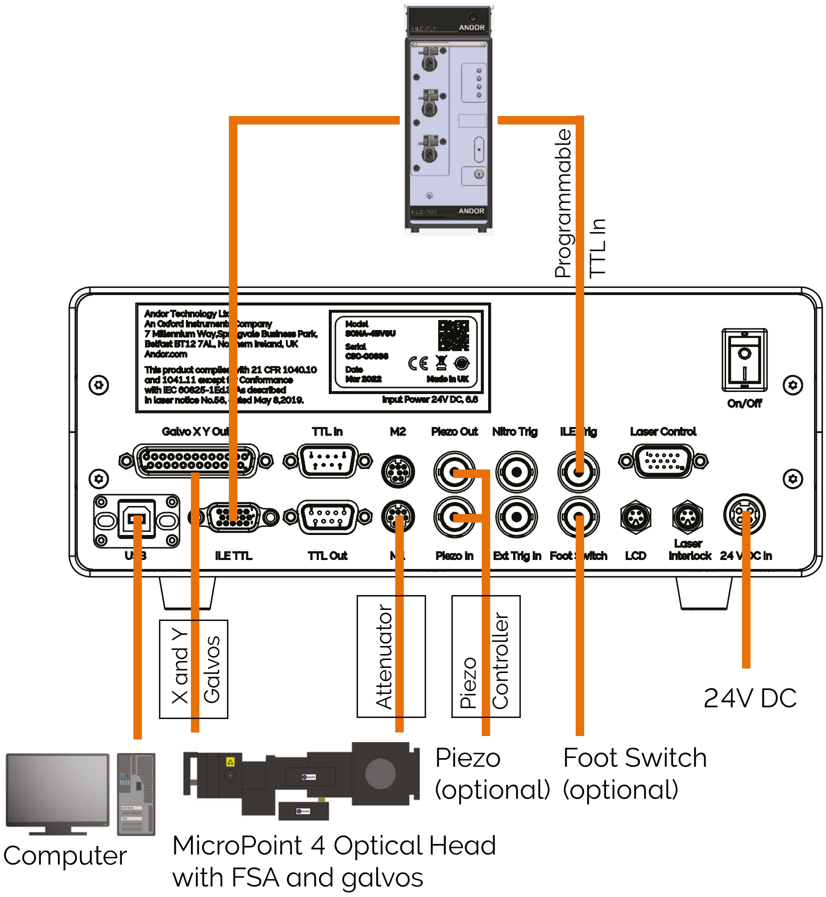


Figure 13: Electrical Connections ILE/HLE PC Galvo version see “Back Panel on MicroPoint 4 Controller” on page 39

2.2.1.3 Pico Laser Galvo Version

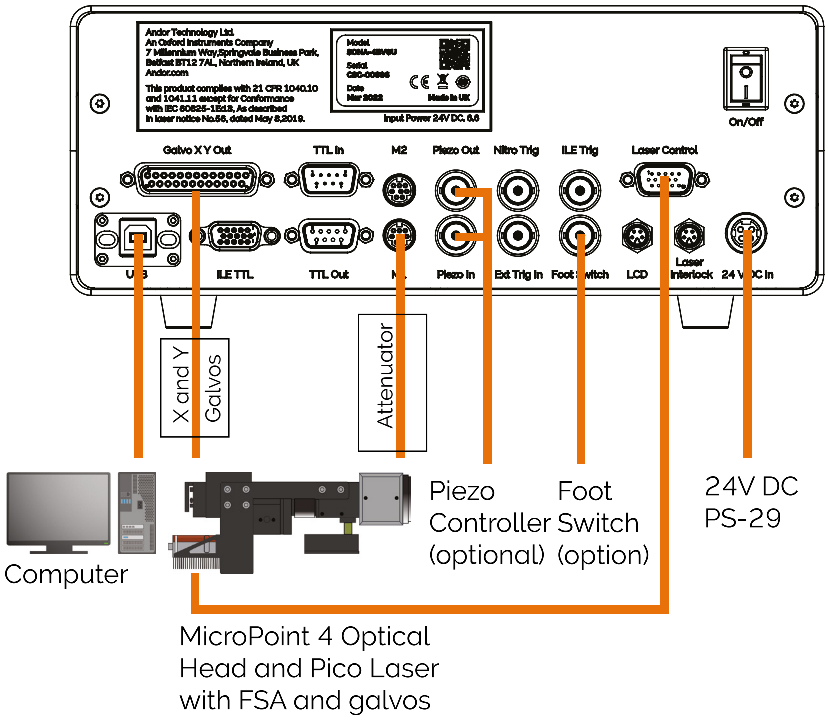


Figure 14: Electrical Connections Pico Galvo Version see “Back Panel on MicroPoint 4 Controller” on page 39

2.2.1.4 Nitro Laser Manual Version

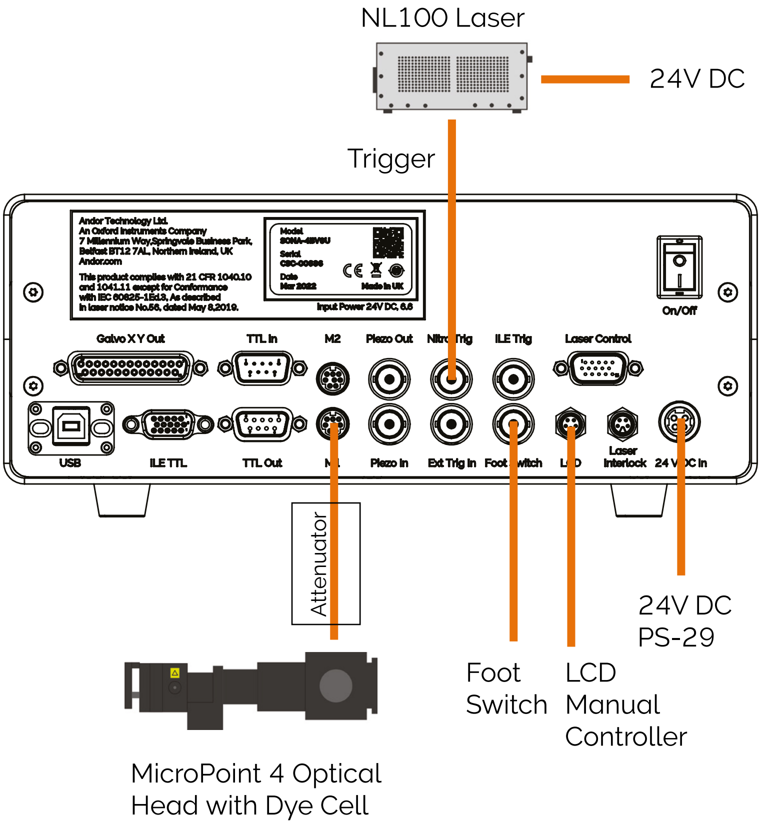


Figure 15: Electrical Connections Nitro Laser Manual Version see "Back Panel on MicroPoint 4 Controller" on page 39

2.2.1.5 ILE/HLE Laser Manual Version

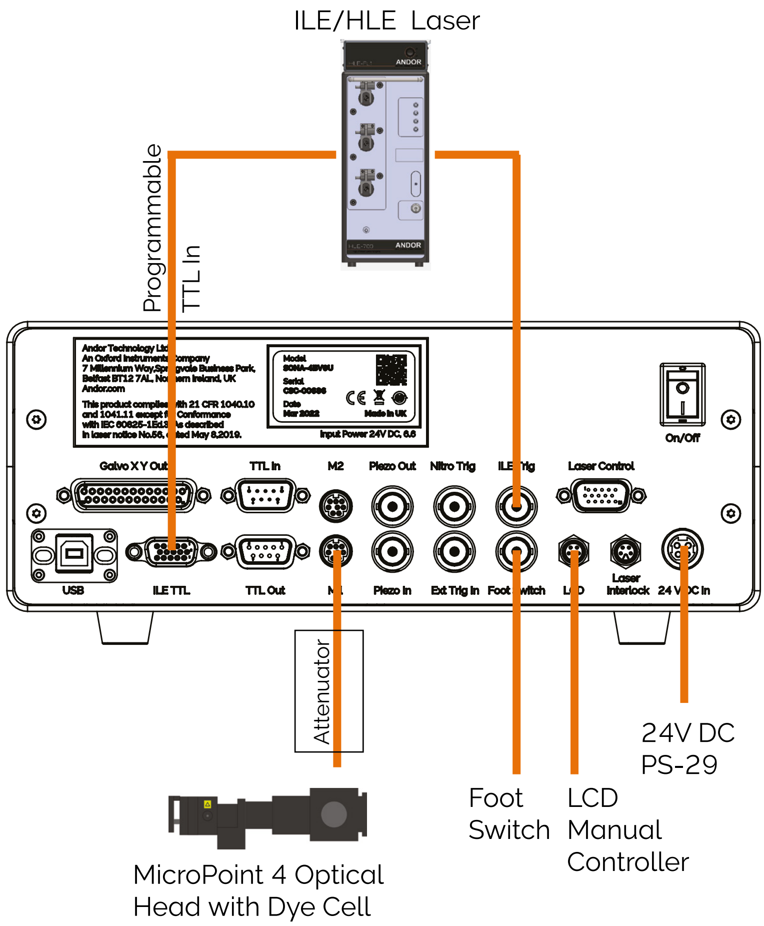


Figure 16: Electrical Connections ILE/HLE Manual version see "Back Panel on MicroPoint 4 Controller" on page 39

2.2.2 Optical Connections

The NL100 laser is connected to the optical head by a 200 µm fibre optic cable for all Nitro models. The ILE/HLE laser is connected to the optical head by a 25 or 50 µm fibre optic cable. The Pico laser is integrated into the optical head so there is no fibre optic cable needed.

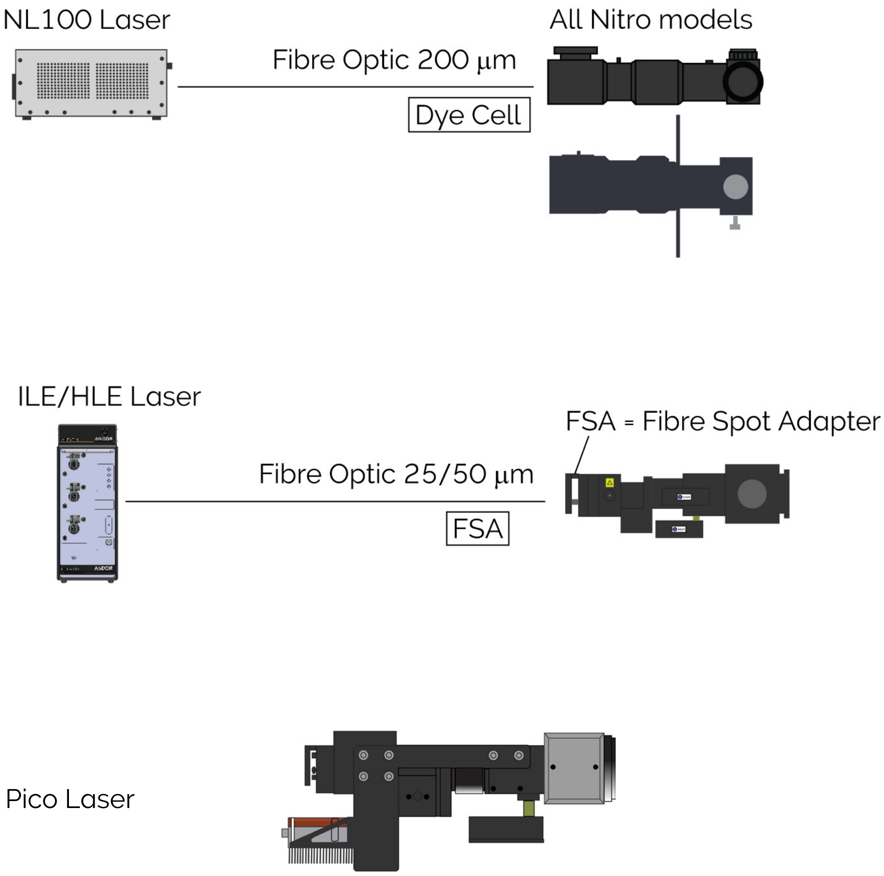


Figure 17: Optical Connections

2.2.3 Interlock Connections

A BNC connector is provided on the MicroPoint 4 controller so that the user can interlock the lasers using external switches. When the interlock contacts are open, TTL signals are prevented from being sent to all lasers and the pico laser is disabled.

If the system is sold with the HLE Class 4 laser lock, there are **two types of interlock** inputs:

1. standard interlock for the microscope components and
2. a remote interlock, typically for the lab door.

After a trigger event

1. When the **microscope interlock** is opened, the user must close the interlock and the laser configuration will be re-established.
2. When the **remote interlock** is opened, the user must close the interlock and then push the button on the Laser-Lock.

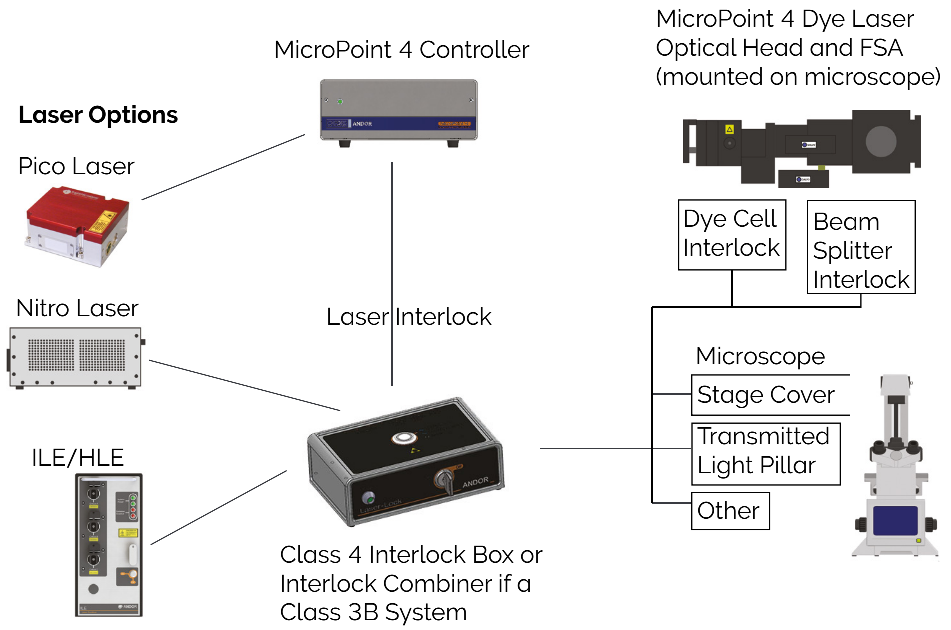


Figure 18: Typical Interlock Connections MicroPoint 4

2.2.4 TTL Outputs from MicroPoint 4 Controller to ILE/HLE

Note the HLE uses the same HD15 as the ILE and the cables are common.

Table 11: TTL Outputs for the ILE and HLE

ILE					
Pin	**Function**	**Pin**	**Function**	**Pin**	**Function**
1	NC (No Connection)	6	NC	11	TTL Out 4[2]
2	Dual output switch	7	NC	12	Ground[1]
3	Ground[1]	8	TTL Out 1[2]	13	Ground[1]
4	NC	9	TTL Out 2[2]	14	Ground[1]
5	NC	10	TTL Out 3[2]	15	Ground[1]
HLE					
Pin	**Function**	**Pin**	**Function**	**Pin**	**Function**
1	NC	6	TTL Out 7[2]	11	TTL In 4 [2]
2	Dual output switch[2]	7	NC	12	Ground[1]
3	Ground[1]	8	TTL Out 1[2]	13	Ground[1]
4	TTL Out 5[2]	9	TTL Out2[2]	14	Ground[1]
5	TTL Out 6[2]	10	TTL Out 3[2]	15	Ground[1]

[1] via 10 kΩ
[2] TTL Logic, (0 - 0.8 V low, 2.0 - 5.0 V high) 5.5 V max 100 kΩ pull down

2.2.5 Back Panel on MicroPoint 4 Controller

This is a photograph of the back panel of the MicroPoint 4 controller.

Figure 19: Connection Panel on MicroPoint 4 Controller

Power Input

For connection to the external power supply unit (PSU) (refer to "MicroPoint 4 Controller Electrical Power Specifications" on page 65). An On/Off switch is also present (shown above).

USB

A USB 3 compatible cable is connected between the USB socket and a PC. We strongly recommend you use the locking device built into the cable.

Table 12: Connections on the back of the Controller

Label	Input/Output/ Communication	Connection	Function
Galvo XY Out	Output	Hardwired to galvos	Laser beam steering
USB	Communication		
ILE/HLE TTL	Output	ILE/HLE Input if used	Laser wavelength and port selection
TTL In	Input	None	Reserved for future use
TTL Out	Output	None	Reserved for future use
M2	Output	None	Reserved for future use
M1	Output	Micropoint optical assembly	Motor control for laser intensity
Piezo Out	Output	Piezo controller	Piezo stage controller analog input
Piezo In	Input	Computer analogue output	Piezo focus offset - wavelength adjust
Nitro Trig	Output	NL100 laser	Trigger for Nitrogen laser pulse
Ext Trig In	Input	External trigger for input	External trigger
ILE Trig	Output	ILE/HLE "Programmable TTL In" BNC connector or BoB OR Input	Trigger if not using ILE/HLE output
Foot Switch	Input	Foot pedal	Trigger stimulation
Laser Control	Communication and interlock	Nd:YAG laser	Control Trigger Interlock Nd:YAG laser
LCD	Input	Hardwired to LCD	Manual control interface
Laser Interlock	Input	Andor Class 4 Laser Lock Box or Andor Interlock Combiner	Turns off Pico if interlock is opened.
24 V DC In	Input	Power pack	Power

2.2.6 Front Panel on MicroPoint 4 Controller

Figure 20: Front of Controller

The light on the front panel indicates the system status.

Yellow	When initialising - for 6 seconds
Green Flashing	It continues initialising - for 11 seconds
Solid Green	When the Controller is ready

During the green flashing phase you can send commands via the touchscreen but not fire the laser.
After the initial boot up:

Green	System is idle and ready to receive commands
Yellow	Armed and awaiting fire command
Red	Laser is currently firing

2.3 Lasers

Refer to laser safety section in the front of the manual for more information.

2.3.1 Laser Intensity Control

The intensity of the laser is controlled manually using the manual slider and motorised attenuator - see section 4.15. It can also be set on the manual LCD controller - see "4.16 Laser Intensity Control" on page 52 - for manually controlled machines or through Fusion for PC-controlled systems.

2.3.2 Laser On/Off Control

See Section "4.3 Power-up Sequence" on page 42 for the power up sequence and "4.4 Power-down Sequence" on page 42

Section 3: Installation

WARNING: THE MICROPOINT SYSTEM MUST BE INSTALLED BY AN AUTHORIZED INSTALLATION ENGINEER ACCORDING TO THE INFORMATION PROVIDED BY ANDOR.

3.1 Location

Please consider a suitable space to install the MicroPoint system in your laboratory or facility prior to Andor Installation. The microscope make and model must be qualified by Andor personnel to ensure compatibility.

3.1.1 Ventilation

Ensure 200 mm clearance around the control unit.

3.2 Assembly

MicroPoint should never be user-assembled. User operations such as exchanging laser sources, dye, dye cells and adjusting focus are covered in "Section 4: Operation" on page 42.

3.3 PC Workstation Operating System Notes

MicroPoint 4 galvo models have been validated for use with Windows 10 Professional.

3.4 Software

The galvo, PC-controlled version of MicroPoint 4 uses Andor's iQ software (iQ stands for imaging and Quantification). Andor iQ version 3.7.0 or later is required for compatibility with MicroPoint 4. Andor iQ can support triggering functions from Fusion software using the USB-BoB (breakout box) to exchange TTL signals between the applications. More details are available in the Andor iQ user guide in the section 'Triggers and Events'. More information on use, applications and calibration of the MicroPoint galvo models can be found in the Andor iQ user guide sections which reference MicroPoint Mosaic and FRAPPA (fluorescence recovery after photo-bleaching and photo-activation).

Fusion is Andor's image acquisition and control software for microscopy instruments and may be pre-installed on the supplied PC workstation. Please see the full Fusion documentation available at fusion.help.andor.com for more information on Fusion.

Section 4: Operation

WARNING: IF THE EQUIPMENT IS USED IN A MANNER NOT SPECIFIED BY ANDOR OR ITS DISTRIBUTORS, THE PROTECTION PROVIDED BY THE EQUIPMENT MAY BE IMPAIRED. PLEASE READ THE USER GUIDES SUPPLIED WITH YOUR SYSTEM COMPONENTS AND SOFTWARE PRIOR TO USE

4.1 Overview

The MicroPoint optical head is a rigid unit that is designed using a heavy exterior that is bolted down.
All mechanical components are made from aluminium.
Note: Do not disassemble the system, as there are no user-serviceable parts inside.
Note: Operation of the computer controlled system is discussed in “4.23 Operation of iQ Imaging Software” on page 56 and the Andor iQ user guide.
In normal operation, the following activities may be performed:

- Replacing the Laser Dye (“4.8 Replacing the Laser Dye” on page 45)
- Selecting a Lamp House Port (“4.10 Selecting a Lamp House Port and Beamsplitter Plug” on page 46)
- Adjusting the laser centration in the microscope focal planes (which may vary with wavelength) “4.14 Laser Centration with Target” on page 48.
- Adjusting the focus which varies with wavelength “4.15 Focusing the MicroPoint” on page 51.
- Adjusting the laser intensity, pulse frequency and pulse number per point “4.16 Laser Intensity Control” on page 52 and “4.17 Pulse Frequency and Number” on page 53
- Resolving interlock events “4.19 Interlocks and Errors” on page 54
- Use with Andor iQ “4.22 Using MicroPoint 4 with Andor iQ” on page 56.

4.2 Emergency Mains Disconnection

In case of emergency, the disconnecting point of the equipment is the mains power cord connected to the external power supply, or the mains socket switch.

WARNING: SWITCH OFF THE POWER AT THE MAINS SOCKET AND REMOVE THE MAINS LEAD FROM THE EXTERNAL POWER SUPPLY.

4.3 Power-up Sequence

1. Turn on the MicroPoint controller using the switch at the back of the unit. The LED on the front panel should show green.
2. Turn on the laser source using the power switch on the device.
3. After switching on the laser, allow 5 minutes for warmup and thermal stabilisation.
4. The lasers have a key switch for safety reasons. The key switch enables laser emission. When you are ready to start using the laser then turn the key to enable laser emission.

4.4 Power-down Sequence

1. If the unit is under software control, close the software first and allow it a few seconds to disconnect cleanly.
2. Turn the key switch to the OFF position.
3. Power off the laser and the MicroPoint controller.
4. If you are powering down a larger system, you can power down using mains distribution outlets. If you adopt this approach, make sure to shut down the computer cleanly before you power down the system.

4.5 The Dye Cell

The MicroPoint supports the classic dye laser, whose wavelength is determined by the laser dye held in a cylindrical, removable dye cell (Figure 21). While in use, the dye cell is housed in the resonator block as shown in Figure 21 b.

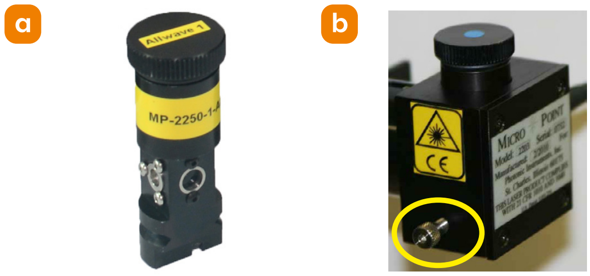


Figure 21: a) The Dye Cell and b) Thumb Screw

A wide variety of dyes ranging from UV to visible can be used to obtain the desired wavelength. A table of available dyes is presented in the section "1.7.2 Laser Dyes" on page 18. Three kinds of dye cells are available depending on the wavelength selected. Popular choices for dye cell wavelengths are 365 nm and 435 nm. To increase efficiency for these wavelengths, dye cells with custom optics must be used. If the 365 nm dye is employed, a dye cell with a green dot on the lid must be used; if the 435 nm dye is employed, a dye cell with a blue dot on the lid must be used. If any of the other dyes are employed a dye cell with a yellow dot on the lid must be used.

365 nm	Green Dot
435 nm	Blue Dot
Other wavelengths	Yellow Dot

CAUTION: THE TOXICOLOGICAL PROPERTIES OF THE LASER DYE ARE DESCRIBED IN THE MSDS SHEET PROVIDED WITH THE DYE. REFER TO THAT DOCUMENT FOR SPECIFIC INFORMATION ABOUT POTENTIAL HAZARDS.

CAUTION: THE LASER DYE IS DISSOLVED IN A HIGHLY-FLAMMABLE SOLVENT, SO AVOID OPEN FLAMES AND SPARKS IN THE LABORATORY.

CAUTION: DO NOT INSERT ANY OBJECT OR BODY PART INTO THE DYE CELL APERTURE, EVEN IF THE SYSTEM IS NOT ENGAGED OR POWERED ON. THERE ARE SENSITIVE OPTICAL SURFACES WHICH SHOULD NOT BE TOUCHED.

4.6 To Remove and Install the Dye Cell

1. Loosen the stainless steel thumb screw located on the side of the resonator block. (Figure 23). The thumb screw is highlighted yellow in Figure 21 b and is located on the opposite side of the block from the optical fibre input.
2. Remove the dye cell from the resonator block by gripping the cap and lifting it upwards (Figure 22). Note: Removing the dye cell will make the system inoperable. A safety Interlock ceases all emission from the laser until the dye cell is properly reinstalled.

Figure 22: Removing/Replacing the Dye Cell

Fibre Spot Adapter (FSA):

3. If the system has a Fibre Spot Adapter (FSA) (Figure 23) on the optical head, to allow use with a CW laser such as Andor Integrated Laser Engine, then a blank cell is provided. The blank cell must be inserted to enable operation with the CW laser. It has an aperture where the dye cell active volume would normally be present. In other respects, it is mechanically identical to the standard dye cell and will allow the safety interlock to operate normally once installed.

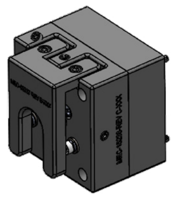


Figure 23: Fibre Spot Adapter FSA

4. To reinstall the dye cell: insert the dye cell into the resonator block by orienting the cell so that it drops freely into the bore. Do not force the cell in the resonator block. Note that the flat side of the dye cell bottom will face the fibre input when in the correct orientation. When the cell is properly installed, the bottom of the cell should be flush with the bottom of the resonator block.
5. When the cell is in place, gently tighten the stainless-steel thumb screw located on the side of the resonator block.
6. If you change the dye wavelength or switch to using the FSA, the focus of the instrument will probably change. To adjust the focus refer to "4.15 Focusing the MicroPoint" on page 51.

4.7 Dye Cell Lifetime

A broad range of liquid laser dyes can be used to change the wavelength of the system. The laser dye optically pumps at 337 nm (the output of the nitrogen laser). Laser dyes have a finite lifetime and should be replaced either every 30,000 pulses or minimally every 2 months. Replacement dye reagents can be obtained from Andor.

4.8 Replacing the Laser Dye

CAUTION: THE TOXICOLOGICAL PROPERTIES OF THE LASER DYE ARE DESCRIBED IN THE MSDS SHEET PROVIDED WITH THE DYE. REFER TO THAT DOCUMENT FOR SPECIFIC INFORMATION ABOUT POTENTIAL HAZARDS.

CAUTION: THE LASER DYE IS DISSOLVED IN A HIGHLY-FLAMMABLE SOLVENT, SO AVOID OPEN FLAMES AND SPARKS IN THE LABORATORY.

CAUTION: DO NOT INSERT ANY OBJECT OR BODY PART INTO THE DYE CELL APERTURE, EVEN IF THE SYSTEM IS NOT ENGAGED OR POWERED ON. THERE ARE SENSITIVE OPTICAL SURFACES WHICH SHOULD NOT BE TOUCHED.

1. Remove the dye cell from the resonator block and wrap the outside of the dye cell with a small amount of paper towel or Kimwipe to avoid any liquid dripping on the external optics as you empty liquid from the dye cell. Unscrew the cap.
2. Discard the old dye in a manner that is consistent with local environmental regulations.
3. Fill the dye cell with a laboratory cleaner such as Alconox®, Sparkle window cleaner or an optical glass cleaner, then empty it. Take care to avoid any liquid dripping on to the external optics.
4. Fill and empty the dye cell several times with water until you are sure that you have removed/diluted out all of the cleaning solution.
5. Fill and empty the dye cell with spectral grade methanol and let the cell dry out.
6. If possible, inspect the resonator windows under a dissection microscope to make sure that they are clear and contamination free. Check the condition of the O-ring. If it is cracked, a new one can be provided by Andor.
7. Refill the cell with dye using the supplied transfer pipette. The level of the dye solution should be up to the middle of the screw threads. Replace the cover and tighten gently.
8. Insert the dye cell in the resonator block. Orient the cell so that it drops freely in the bore. Do not force the cell in the resonator block. When the cell is properly installed, the bottom of the cell should be flush with the bottom of the resonator block. When the cell is in place, gently tighten the stainless-steel thumb screw located on the side of the resonator block (see Figure 22 and Figure 23).

4.9 Replacement of Dye with Different Type of Dye

1. If you change to a different dye, it is recommended that you use a new cell, as traces of the old dye in the new dye solution may cause problems e.g. shifting or reducing emission intensity. If using 364 nm dye or 435 nm dye, ensure you are using the dedicated dye cell for those wavelengths as described in "4.5 The Dye Cell".
2. If a new cell is not available then carefully follow the cleaning procedure in "4.8 Replacing the Laser Dye" on page 45.

4.10 Selecting a Lamp House Port and Beamsplitter Plug

WARNING: LAMPS SHOULD NOT BE REMOVED FROM THE MICROPOINT UNIT, THIS IS A SERVICE PERSONNEL ONLY OPERATION

You can select the left or right lamp house port by rotating the beam splitter selection knob so that one mark points to the microscope and the other points to the desired lamp house port. Magnets and kinematic mounting on the beam splitter plug align and lock the unit in position.

4.11 Inserting the Magnetic Beam Splitter

If an external lamp/LED for epifluorescence is used, a variety of magnetic beam splitters are included to either combine the MicroPoint photostimulation light path with the epifluorescence path for specimen observation, or choose between them for maximum efficiency. More information on the beamsplitters we have available is in Section 1 Table 7 on page 24 . These fit from above into the circular aperture of the lamphouse block as shown in Figure 24. If there is no need to combine epifluorescence with the dye laser, then a blank beam splitter body is included, with no optical component installed. It will still carry the safety interlock, so must be installed for MicroPoint operation.

Figure 24: Beam Splitter in Lamphouse Block

WARNING: BEFORE CHANGING A BEAM SPLITTER, VERIFY THAT THE LASER IS TURNED OFF.

1. To install a different beam splitter, remove the one in the lamphouse block and insert the new beam splitter. The beam splitter assembly features a magnet and kinematic mounting to ensure proper alignment and to activate the interlock circuit for laser safety.

4.12 Removing the Magnetic Beam Splitter

WARNING: BEFORE CHANGING A BEAM SPLITTER, VERIFY THAT THE LASER IS TURNED OFF.

WARNING: DO NOT INSERT ANY OBJECT OR BODY PART INTO THE BEAM SPLITTER APERTURE, EVEN IF THE SYSTEM IS NOT ENGAGED OR POWERED ON.

1. If it is necessary to remove the beam splitter, grasp it by the top, and lift it from the lamphouse block. Replace the beam splitter by placing it into the lamphouse block. Note that the beam splitter can be inserted two different ways depending on the side of the lamphouse block being used. Always insert the beam splitter with the glass surface facing towards the external lamp/LED. A magnetic pull will be felt as the beam splitter slots into place, and if it is oriented correctly, the laser safety interlock will enable emission.

Note: Removing the beam splitter will make the system inoperable. A safety Interlock ceases all emission from the laser until the beam splitter is properly reinstalled.

4.13 Inserting Excitation Filters

WARNING: THE SYSTEM SHOULD NOT BE OPERATED WITHOUT A FILTER HOLDER IN POSITION.

WARNING: THE LAMPHOUSE FILTER SHOULD NOT BE REMOVED WHILE THE MICROPOINT IS IN OPERATION.

WARNING: BEFORE CHANGING THE LAMPHOUSE FILTER, VERIFY THAT THE LASER AND LAMP ARE TURNED OFF.

WARNING: DO NOT INSERT ANY OBJECTS INTO THE FILTER'S APERTURE EVEN IF THE SYSTEM IS NOT ENGAGED OR POWERED ON.

In rare cases where a white light lamp is used instead of a wavelength-selectable LED light source, manual excitation filters can be used in the optional MicroPoint lamphouse port filter slot. Place the filter as shown in Figure 25. Note that the arrow is pointing away from the lamp. Filter wheels can be installed in a similar manner.

Figure 25: Inserting Excitation Filter

4.14 Laser Centration with Target

Laser centration is somewhat wavelength dependent so should be checked when changing laser source, especially when switching between CW and pulsed lasers. MicroPoint has two mechanisms for beam steering: the first is used to centre the beam at the input of the focusing optics; the second is used to set the position of the laser beam in the specimen plane.

The first mechanism is common to both manual and galvo models and involves a manual beam displacer, located immediately after the dye cell resonator block, as shown in Figure 26 a and b. This should be set first and does not require the laser to be emitting.

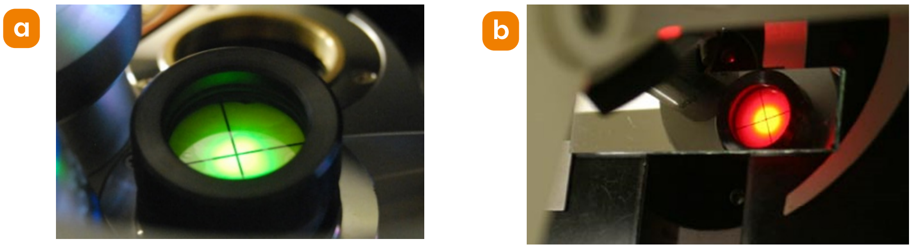


Figure 26: Laser beam centred at the back focal plane target a) inverted scope b) upright scope with mirror slide

A hex key is used to rotate (X) and tilt (Y) the element to centre the beam as it enters the focusing optics – see Figure 27. Note that the steering optic is factory aligned, so should only require only small changes. It is set as follows.

1. Centration of the first adjuster - manual and galvo models

Install the fluorescence target in the objective turret (Figure 25).

X (rotation): rotate the screw to align the reference line on the ball to the slot axis (Figure 27).

Y (tilt): tilt the Allen screw to centre it in the long axis of the slot (Figure 27).

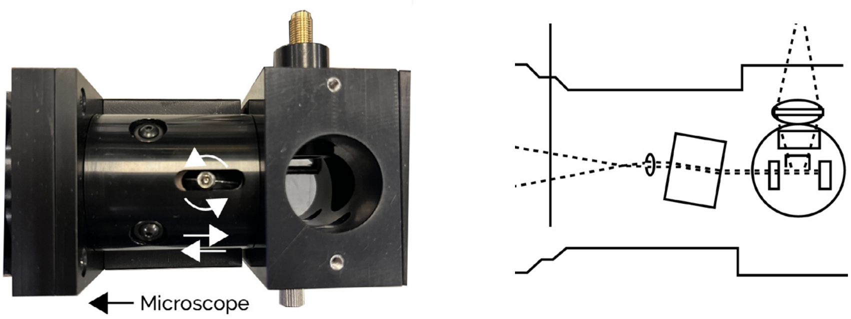


Figure 27: First alignment optic schematic

2. Centration of the second adjuster in manual MicroPoint models

To centre the beam in the objective back focal plane, the second steering optics is first **set to the factory default position** as described in point 1. above for the first axis - see Figure 27**.** Once the beam is roughly centred in the back focal plane of the objective – **make sure to use the fluorescent target** (Figure 26) – you will see the laser profile similar to that shown in Figure 29. The primary beam spot is circular (see Figure 29) and needs to be centred on the target.

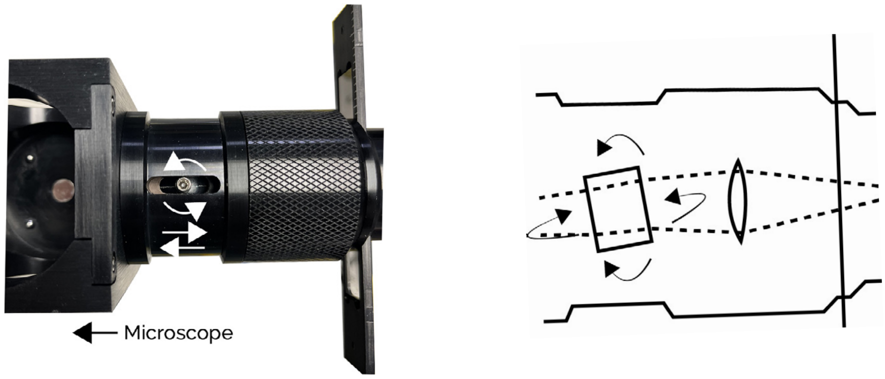


Figure 28: Second beamsteering in manual model

3. Centration of the laser beam in MicroPoint 4 galvo models

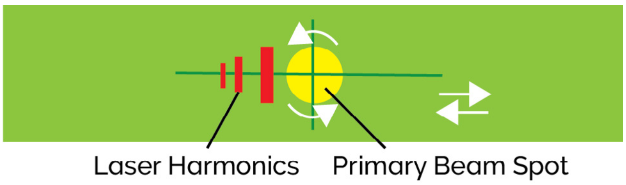


Figure 29: Dye Laser Beam Profile and Steering Moves

4. **MicroPoint 4 galvo models have independent X and Y steering, managed by the smart controller**. When the controller is powered and connected to the control software, the default galvo positions are set to the centre of their range, which corresponds to the centre of the field of view. Assuming step 1 above is complete, the default galvo positions should allow the beam to be near the target centre.

Fine adjustment of the spot in the specimen plane.
Select the desired objective and install or select it on the microscope turret. Using the focus procedure in Section "4.15 Focusing the MicroPoint" on page 51, adjust the laser until you can cut small holes in the mirror slide. Using either the ocular target with laser safe filter cube, or the imaging system camera, you can now make final adjustments.

For **manual models**, adjust the second beam steering component by rotation and tilt until you are satisfied with the beam position. Once centred the specimen can be moved with a fine stage to place the desired target at the stimulation point.

For **galvo models**, to adjust beam centration, use the software to select the 'Centre Galvos' option on the UI (user interface). Then loosen the galvo locking screws, circled in red in Figure 30, and make small rotational adjustments of the X and Y galvo bodies until the cutting is centred in the field of view. Lock the screws finger tight, but not aggressively.
Figure 31, shows a typical example calibration sequence using Andor iQ and MicroPoint 4 with a mirror slide viewed in transmitted light.

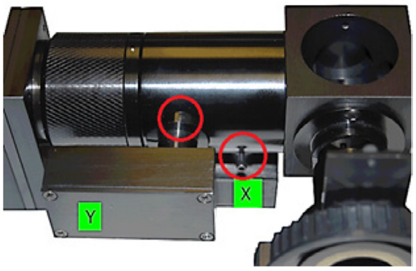


Figure 30: X and Y galvos - release locking screws to adjust X and Y centration

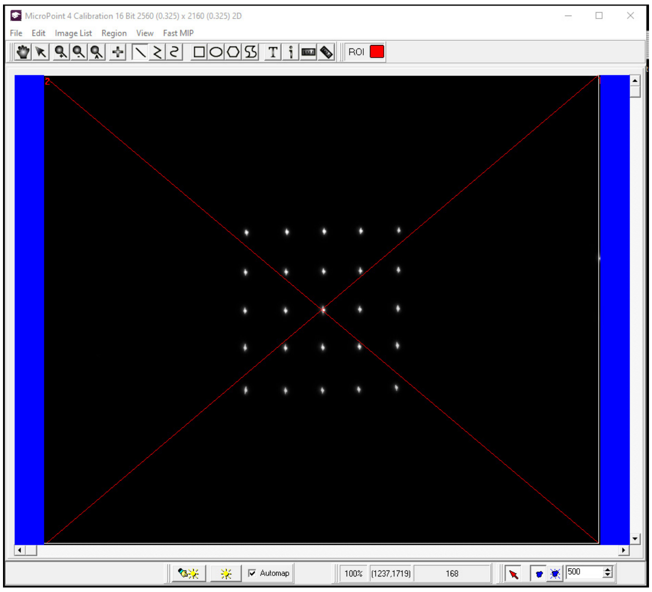


Figure 31: MicroPoint 4 and Andor iQ calibration pattern cut into chrome-on-glass slide, viewed in transmitted light.

4.15 Focusing the MicroPoint

The MicroPoint has its own focus mechanism to ensure that it remains parfocal with the microscope oculars and/or imaging ports. When the MicroPoint is installed by Andor and used with a single dye cell, it will be focused for use with your preferred photostimulation objective lens, so you should not need to adjust focus by very much unless the objective, specimen type or mounting medium has changed. If you do need to make small adjustments, the focusing ring is located on the MicroPoint body as shown in orange in Figure 32. Clockwise (CW) rotation will bring the plane of focus closer to the objective lens, while counter-clockwise rotation (CCW) will bring focus closer to the specimen.

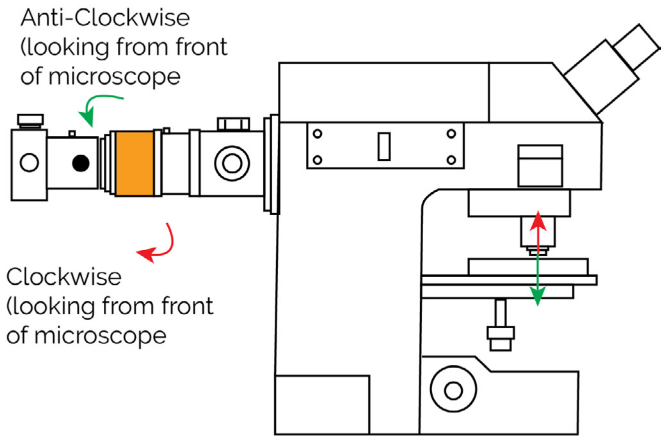


Figure 32: Adjusting the focus on the Optical Head

Wavelength Specific Laser Adjustment:

1. If you change the dye cell wavelength, or switch Pico between 355 and 532 nm you will need to refocus the system. To adjust the MicroPoint focus it is a good idea to use the chromium plated glass slide that is supplied with your instrument.
2. Observe the slide in transmitted light and focus in the oculars or on the system camera. The slide has some scratches on the surface on which you can focus precisely.
3. Once focused, switch the selected laser to continuous trigger mode and observe the glass slide. For the NL100 see Figure 33 - the internal trigger setting is highlighted in the top left corner in red. Provided there is sufficient laser intensity (start at 60% - see Section 4.15) and the focus is close, you will see a spot appear each time the laser delivers a pulse. While the laser is pulsing, you should move the XY stage slowly and smoothly to present a fresh area for the laser to pulse.

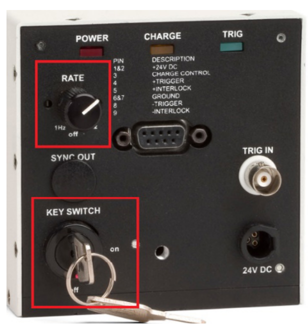


Figure 33: Set Trigger Rate - top left

4. To optimise focus, adjust CW and CCW in small amounts (~10 degrees) to discover in which direction the spot size gets larger. Make fine adjustments to optimise and then reduce the intensity to 40% and continue to optimise focus and intensity until you find the lowest intensity at which clear sharp spots appear for each pulse.

5. It is a good idea to mark the focus ring with something like nail varnish, coloured lab tape, or a paint pen and colour code the marks. This will simplify future adjustments.

CW Laser Adjustment with FSA:

1. If you use a continuous wave (CW) laser such as the Andor ILE with the Fibre Spot Adapter and change source wavelength, you will need to adjust focus. Unlike the dye laser above, the FSA requires use of a fluorescent slide, e.g. kidney or highlighter pen, so that the laser bleaches fluorescence in the specimen. You can adjust focus in one of two ways with the MicroPoint 4.

   a Mechanical focus. Adjust focus by starting at a relatively high intensity and incrementally minimising the spot size and the intensity until you reach a small tight spot (~20 Nyquist pixels is common).

   b NEW Piezo offset feature of the MicroPoint 4 controller. This feature is available for USB controlled models only. If you have a piezo stage insert or piezo objective with analogue (0-10 V) control, then you can use the piezo offset to adjust the axial position of the objective or specimen when the photostimulation (PS) laser is triggered. The MicroPoint 4 will return the piezo to the imaging stage/ objective position after the PS event is complete. If you record a piezo offset value per PS wavelength, then MicroPoint 4 will automatically apply the offset for each triggered PS event. To rewire your piezo, take the 0 - 10 V BNC cable which is plugged into the piezo controller and move it to the MicroPoint 4 'piezo in' connection. Then connect a BNC from MicroPoint 4 'piezo out' to the piezo controller 0 - 10 V analogue input. The user interface in Andor iQ will support setting the piezo offset for all wavelengths specified by the user. The default offset is zero, but it can be set in the range ±2048 counts or ±2 Volts. One count corresponds to 0.5 mV and the range is ±20% of the piezo range.

4.16 Laser Intensity Control

The MicroPoint has two methods of intensity control:

- the primary source can be controlled either via manual slider, or for the CW laser (ILE), electronically.
- the Pico laser delivers a fixed pulse energy 2 µJ at 355 nm and 10 µJ at 532 nm.
- the MicroPoint 4 optical body has a motorised attenuator which offers 0 - 3 optical density units (OD).

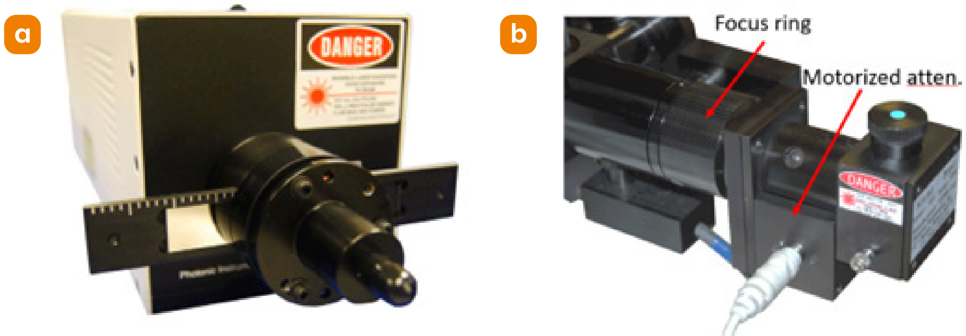


Figure 34: a) Manual attenuator slider on NL100 laser b) Motorised attenuator (0 - 3 OD)

1. The manual linear slider on the NL-100 laser is located as shown in Figure 34. This is normally set to nearly zero attenuation for high energy applications like ablation or cutting. It can be adjusted to reduce power delivery and then the motorised rotary attenuator will provide finer changes in the pulse intensity delivered to the specimen (Figure 34b). This is useful when the resolution of the motorised attenuator is insufficient to achieve the correct level of stimulation on adjacent increments. Note the attenuator steps are not linear, but logarithmic. So for example, to increase the resolution of the motorised attenuator by a factor of 2 per step, adjust the NL-100 attenuator to deliver half the energy (10*log(2) = 0.3 OD) by setting 0.3 OD on the slider. Then adjusting the motorised attenuator, change the incremental energy at twice the resolution (equivalent to half steps).

2. The CW laser systems use mainly solid state lasers and these can be electronically set over a range of 2 - 100% intensity with 1% resolution. This control is linear, so in the example above you would set the laser intensity to 50%. Once again this can be combined with the motorised attenuator to provide fine control over the delivered laser intensity.

4.17 Pulse Frequency and Number

Both motorised and manual MicroPoint models can control pulse frequency and number. Pulse frequency determines the number of pulses delivered per second, while pulse number determines the number of pulses delivered per trigger event, or for motorised scanning, for each point in the scanned pattern. These are useful controls because experience shows that delivering energy to the specimen in several lower energy pulses, may be more effective and controllable than a single higher energy pulse. In addition, the frequency of pulse delivery will also influence the response to, or recovery from, the stimulation. See Figure 35 for the software interface settings.

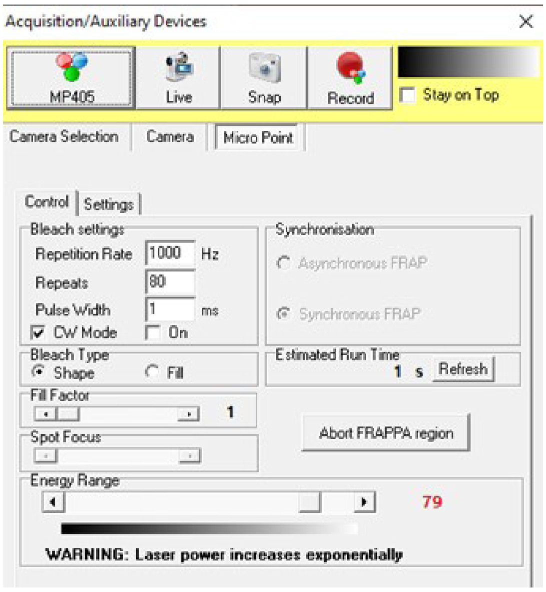


Figure 35: Galvo model GUI in Andor iQ software

The NL-100 pulsed laser has a maximum frequency of 20 Hz (pulses per second) and has a maximum number of 80 pulses per trigger event. This is set through either the LCD panel for the manual models or the software interface for USB models.

1. Continuous wave (CW) ILE lasers, when available, can deliver pulses with frequency 1 - 1000 Hz, a user-defined pulse width of 1 - 60,000 ms and a pulse number of 1 - 80 per trigger event or scanned point. In that case select the CW Mode checkbox below Pulse Width on the device UI shown in Figure 35.
2. For galvo models, there is an additional parameter: Fill Factor. This determines the density of photostimulation laser spots in a scanned pattern. Higher numbers result in lower density scanning. This is useful when the user wants to stimulate a region of interest quickly and overlap of spots within the pattern can be traded against speed of action.

4.18 Using the MicroPoint 4 Piezo Offset Feature

If you have an analog piezo stage or objective drive, you can make use of this feature to momentarily change the specimen Z position during photostimulation (PS). The stage is reset to the original (imaging) Z position after the PS action. This feature allows the user to **correct for axial chromatic aberration** in the optical train from MicroPoint 4 to the microscope objective. Chromatic aberration results in different focal planes at different wavelengths. Piezo offset allows you to set an offset value for each of the wavelengths you want to use and once set it will be automatically applied during PS. This is particularly useful if you use both UV and visible lasers in your PS work.

Carry out the following steps.

1. First, with power off, connect the analog output from your 0 - 10 V DAC (Andor USB-BoB for example) to the Piezo In BNC on the back of the Micropoint 4 controller.
2. Then connect the Piezo Out BNC on the MicroPoint4 controller to the 0 - 10 V input of your piezo stage controller.
3. Power up your system, start the imaging software and confirm that you have normal control of the piezo focus. Set the piezo to about mid-range.
4. Set the microscope focus to the desired specimen plane for imaging.
5. Adjust the focus of the MicroPoint4 optics to be parfocal with the imaging plane for the most commonly used wavelength. To do this, aim for the smallest spot size as described in “Focusing the MicroPoint” on page 51. If using a CW laser, e.g. Andor ILE or HLE, use a low power to avoid rapid bleaching.
6. Use the piezo offset to correct other PS wavelengths to parfocal as follows: select the laser in the PS channel (called FRAPPA channel in iQ). Set the laser to low power so you can see the spot but to avoid excessive bleaching. Set the wavelength in IQ and adjust the offset to give the smallest laser spot.

   The offset range ± 2048 count, will give you plus ± 12.5% of the piezo range. Store this value. It will be retained in the Micropoint 4 controller internal memory between imaging sessions.
7. Repeat as desired for PS Channels which use different wavelengths.
8. Now when you activate selected OS channels either in Protocols or interactively, the piezo offset will be applied immediately before PS action and removed immediately after.

4.19 Interlocks and Errors

Since MicroPoint 4 models share a controller, interlocks are shared between them. An interlock circuit essentially detects an open circuit anywhere in its loop. When multiple laser-based instruments are connected they must use an interlock combiner to connect the instruments and ensure user safety. MicroPoint can be supplied as a stand-alone device or combined with larger Andor systems (e.g. Dragonfly, Mosaic) or to third party systems (e.g. confocal microscopes) and is offered with CDRH-compliant, laser safety interlock systems. Whenever an instrument enters a state which interrupts an interlock circuit, it will trigger an interlock error state. In the MicroPoint 4, the front panel LED (see Figure 36), will show as RED. When the LED is GREEN the interlock and other diagnostics are all complete and healthy. When the LED is AMBER, then a self-test has failed and a service call is required.

Figure 36: Controller status green

4.20 Risk Mitigation

Please see "SAFETY AND WARNING INFORMATION" for more information on risk mitigation.

4.21 The MicroPoint 4 LCD Controller

Once the MicroPoint 4 has been focused and centred, experiments with specimens are executed via computer control (galvo models) or the manual LCD control interface. The LCD plugs into the main controller (see Figure 36) and provides the user with a simplified user interface to set laser pulse number, frequency, intensity and trigger source to initiate photostimulation. The LCD screens in Figure 37 show the sequence and transitions between screens. Screen 4 allows the user to Load and Save settings in the controller memory for easy recall. Up to three settings can be saved and recalled to simplify configuration for different experimental scenarios.

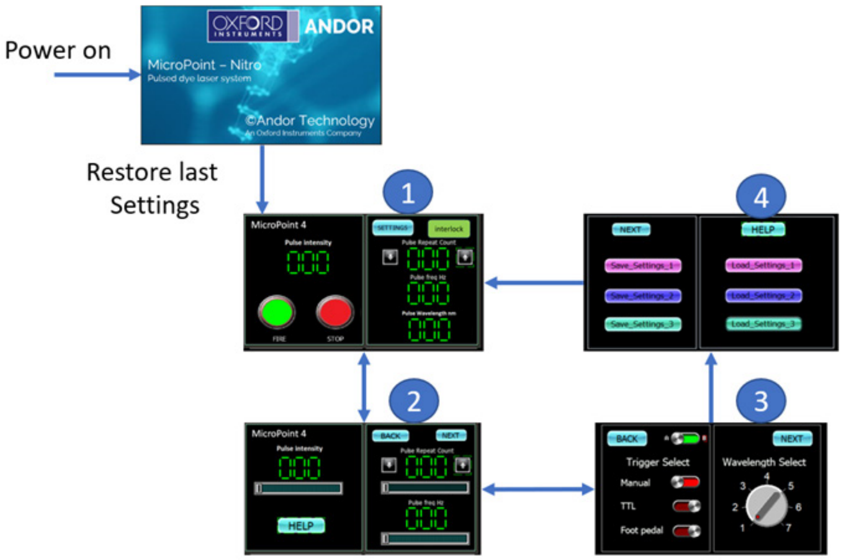


Figure 37: LCD controller, power up and setup screen sequence. The LCD plugs into the main controller and provides a user interface (UI) for system setup, including laser properties and triggering. On screen 1, the system is ready to start work with settings from the last session. On screens 2 and 3 laser and trigger parameters are set. While on screen 4, the user can load and save settings to ensure repeatable conditions for up to three photostimulation scenarios.

4.22 Using MicroPoint 4 with Andor iQ

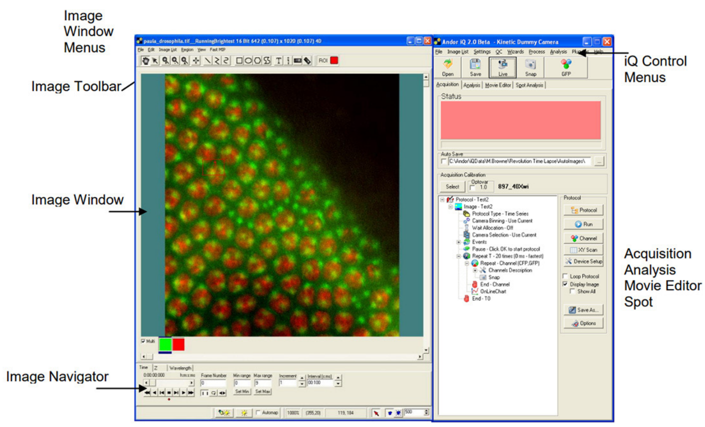
The Andor iQ3 user guide explains how to use acquisition protocols and how to execute interactive targeting. Here we provide a list of sections you can refer to for guidance. When the installation of MicroPoint 4 is completed, our service team will provide you with some basic hands-on training. More advanced training is available for puchase, please contact your Andor Representative for more information.

1. In section 3.6 of the iQ3 user guide you will find an introduction to photostimulation and how it is handled in the software, As well as MicroPoint we have Mosaic, a DMD based device for complex patterning.
2. In section 3.6.6 you will find the details of how to calibrate MicroPoint with the pulsed dye laser and glass slide.
3. If you are calibrating MicroPoint with a diode laser then follow the section 3.6.5 which refers to FRAPPA. Here a fluorescent slide will be required as test specimen, as mentioned above.
4. Once calibrated MicroPoint is ready for use. At this point you can graduate to Chapter 4, where acquisition protocols are described.
5. You will find section 4.1.2 especially useful for MicroPoint as you can define a sequence of execution and FRAPPA actions.
6. Sections 4.6 and 4.8 will also be useful for flexible protocol setup and triggering.
7. When you trigger MicroPoint 4 to stimulate the specimen (manually or via protocol) use section 5.3, Series analysis will be useful for observing the effect of the stimulus graphically.
8. As Andor iQ3 is mostly used as a supporting software, the virtual camera is often supplied so that iQ3 can acquire an image from the 3^{rd} party software in the 3^{rd} party image window. For more information on the virtual camera see A3.18
9. If you do acquire in Andor iQ, it is possible to analyse FRAP (fluorescence recovery after photobleaching) data, See section 5.13
10. For more details on how to setup MicroPoint for specific tasks see A5.19

4.23 Operation of iQ Imaging Software

We recommend that you download the latest **iQ User Guide** from the software section of our website. This excerpt below is from the iQ3 version.

The iQ3 nD tree view User Interface



How to Setup MicroPoint for Uncaging

For uncaging, focus is critical because it is typically done at energy levels below bleaching. You must take into account the cover slip and any medium in which the specimen exists. The following are the steps to find the best focus setting:

1. Take a slide in which you can identify single microtubules or actin filaments, or similar. With a DAPI cube in place and mercury lamp, illuminate the specimen, The UV cube should be transmitting 365-400 nm – mercury has lines at 365 and 405 nm. Get an idea of how long the filaments take to bleach to 50% intensity – a camera helps. This time will give you an idea of how long you may need to pulse the 365 nm MicroPoint for similar effect.

2. Turn the 365 nm energy level down below the damage threshold and try the same thing with the MicroPoint – pulsing continuously for several seconds if needed. Make a note of how long this takes. Again it will depend on the energy setting, but also on the objective transmission and the focus of the MicroPoint.

3. Spot one of the filaments and trigger the MicroPoint to output 5 - 10 pulses. You should see some bleaching. If not increase the power a little until you do. Now continue this process, changing the focus in between bleaching actions, reducing energy when possible at each step. You should be able to get to the point of bleaching a single filament with a resultant spot in the order of the diffraction limit of the objective.

4. When you go to the cell culture, you may have to correct again by a similar approach to 3 above because you are now in "water" or thereabouts and focus will again be shifted.

   Once you have setup MicroPoint for a given objective and specimen, you should note the setting for later experiments.

Section 5: Maintenance and User Service Procedures

Maintenance describes a series of activities that should be performed on a routine basis to optimise the performance of the system and minimise down time. The system is designed to require a minimum amount of maintenance.

Note: The suggested frequency of the operations described below is dependent on the amount of use of the system and the number of operators. As the user gains experience with the system, it will be found that the frequency of some activities should be done more frequently and others can be done less frequently.

5.1 Cleaning and Decontamination

The most critical aspect of maintenance is to ensure that the system is kept in a clean environment that is suitable for sensitive electro-optical equipment. The laboratory should be free of dust, fumes and other materials that could affect the system.

Daily

- Visually inspect the system.
- In a multi-application environment, check that the appropriate filter and dye for your application is present.
- Perform any maintenance activities suggested by the microscope manufacturer.

5.1.1 Procedure for Cleaning Dye Cells

Changing your laser dye on time, and putting dye cells away clean and dry when not in use is the best way to avoid problems.

If you notice a loss in the output of your MicroPoint Laser System we recommend that you clean your dye cell and change the laser dye using the following procedure:

Figure 38: Dye Cell

1. Empty the dye cell of all used dye.
2. Fill the dye cell with one of the of the following:
   - Methanol
   - Water
   - Sparkle – glycol based- window cleaner or equivalent. Do not use cleaners containing ammonia.
   - A laboratory glass cleaner such as Alconox dissolved in water
   - Optical glass cleaner
   - Acetone etc…for short times as it may damage the dye cell
3. Empty the dye cell.
4. Rinse the dye cell with water several times, until you are sure you have diluted out the cleaning solution.
5. Rinse the dye cell with clean spectral grade methanol.
6. Let the dye cell dry out.
7. If possible inspect the resonator windows under a dissection microscope to make certain that they are clear and contamination free.
8. Refill the dye cell with fresh dye.
9. Please note that a combination of cleaning agents may be needed to remove contamination.

5.2 System Alignment

The system is aligned during installation and no additional alignment should be required in use. If it is suspected that the system is misaligned please contact your Andor Technology Representative.

The following sections describe user procedures for maintaining the MicroPoint instrument including cleaning and decontamination operations.

5.3 Regular Checks

The state of the system should be checked regularly, especially the integrity and condition of the connecting cables and mains cables and optical fibre. Do not use equipment that is damaged.

On a Daily Basis:

- Visually inspect the system.
- Perform any maintenance activities suggested by the microscope and camera manufacturers.

On a Weekly Basis:

- Ensure that all power cables are firmly in place.
- Check the optical cables and connections to ensure that the locks are in place and no damage has occurred to the optical fibres connecting the various elements of the system.

5.3.1 Minimum Computer Requirements

MicroPoint Galvo models only.

- I5 processor, six core, 3.3 GHz base frequency
- 32 GB RAM
- Hard drive(s) capable of sustained rate of 200 MB/s
- USB 3.2 (Gen 1) High Speed Host Controller
- Nvidia Quadro P1000 video card
- Windows 10 Professional or Enterprise Edition

Please note USB 3.0, USB 3.1 (Gen 1) and USB 3.2 Gen 1x1 are equivalent.

5.3.2 Annual Electrical Safety Checks

- It is advisable to check the integrity of the insulation and protective earth of the PSU on an annual basis, e.g. U.K. PAT.
- Do not use equipment that is damaged.

5.4 Maintenance Packages

Andor offer a variety of maintenance packages, designed to maximise return on investment, tailored to suit the needs of the customer, ensuring that global expertise is delivered locally.

For more information on the packages available, please visit our website.

5.5 Service Options

A range of services are available for the MicroPoint, these include:

- Installation qualification
- Operational qualification
- Maintenance packages
- Onsite and depot repair
- Spares and consumables

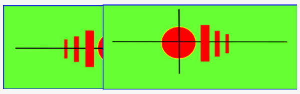
For more information or pricing, please visit our website.

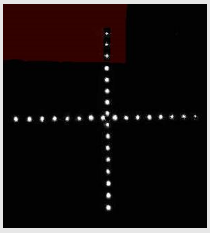
5.5.1 Returning the MicroPoint for Maintenance

To return the MicroPoint for maintenance or repair please contact our customer support team who will be able to advise you further.

Section 6: Troubleshooting

6.1 Troubleshooting Examples

Fault	Possible Cause	Action
Dye Cell Evaluation	Dye cell contaminated or out of tune.	1. Put an apple green Post-it-note onto a microscope slide and position it under the microscope nosepiece. 2. Swing the microscope nosepiece to an open position with no objective or dust plug. 3. Make sure that the attenuators are in the clear or fully open position. 4. Switch the microscope to the laser delivery filter set. 5. Turn the laser on and run it at about 10 Hz so that the laser beam is projected down/up onto the Post-it-note mounted on a microscope slide, see below.  6. The image of the laser beam may or may not be reversed depending on the characteristics of your microscope illuminator, however you should observe a large primary laser beam with several clearly defined harmonics off to one side or the other. 7. If instead of the above image, you see a large fuzzy beam without defined harmonics, your dye cell is either dirty/contaminated or out of alignment. See Procedure for Cleaning Dye Cells Section "4.8 Replacing the Laser Dye" on page 45.
USB controller has no 'on' light or galvanometers do not move		1. Check power cable. 2. Check fuse. 3. Contact Andor for service support.
No Laser		1. Make sure laser is switched on, the shutter is open and laser output is sufficient. 2. Check fibre optic element transmission and output. 3. Make sure a) a filled dye cell is installed in the resonator block, that it is b) matched to the proper fluorescence cube, and c) the two position magnetic beam splitter is installed in the lamphouse tube. **Please note that a shutter closes when beam splitter plug is removed.** 4. Make sure all shutters, sliders and neutral density filters are in the open position and/or removed from the light path. 5. Make certain aperture and field diaphragms are open. 6. Make sure laser light can be seen on alignment screen. 7. Make sure the objective you are using transmits at the wavelength you are using. 8. Make sure the correct microscope filter cube is in place - if the microscope has a fluorescence axis.

Low Power		1. See laser power chart. 2. Check dye cell is clean.See "5.1.1 Procedure for Cleaning Dye Cells" on page 58 3. Make certain you have selected the correct beam splitter. 4. Make sure the correct microscope filter cube is in place - if the microscope has a fluorescence axis. 5. Make sure the selected objective transmits at the dye cell wavelength you are using.
MicroPoint wont focus **WARNING: USING THE MICROPOINT GROSSLY OUT OF FOCUS AT HIGH POWER CAN DAMAGE THE OPTICAL COMPONENTS!**		If you cannot properly focus the MicroPoint after using the steps described section "4.15 Focusing the MicroPoint" on page 51, we suggest you try the following. 1. Carefully recheck laser centring using the Target Screen. 2. Now follow the Parfocalization sequence again. 3. If you cannot attain perfect parfocality between the MicroPoint and the Microscope, please contact Andor.
Unever Power Distribution when Calibrating		1. Make sure you are using a flatfield objective - notation on objective should be "Plan". 2. Make sure stage is flat, using first surface mirror. 3. Carefully recheck laser centring using Target Screen If you still get an uneven power distribution then… 4. Click "Centre Galvos" using Andor iQ to set galvanometers. 5. Align laser primary beam to laser Target Screen using alignment control socket and T-handle.  6. Parfocalize laser and microscope optics. 7. Align laser spot to centre of field of view by rotating galvanometers. 8. Re-check alignment on laser alignment screen.

Appendix A: Technical Data MicroPoint 4

Control

	Manual	Galvo
Controller	Smart controller with LCD touch screen	Smart controller with USB to PC
Triggering	Manual, Foot pedal, Ext TTL	Software, Foot pedal, Ext TTL
Field of illumination	Fixed beam (user adjustable)	Approx 6 x 6 mm
Settling Time (ms)	N/A	1-5 (step size dependent)

Optical

	Nitro Dye Laser	Pico Laser	CW Laser
Wavelengths	365 nm - 656 nm	355 nm and 532 nm selection via filter slider	400 - 780 nm
Attenuation MicroPoint 4	Motorised rotary ND:3OD, ninety steps, 0.1 - 100% transmission (log scale)		
Attenuation at Laser Source	0.1 - 3OD - 0.1 - 100% ND slider	N/A	2 - 100% electronic
Resolvable Spot Size	Near diffraction limited	Near diffraction limited	Approx 4 x PSF FWHM (~2 µm @ 60X/1.2 NA)

Laser Sources

	Nitro Dye Laser	Pico Laser	ILE option	HLE option
Average Power (Max)	300 µW	4 mW @ 355 nm, 20 mW @ 532 nm	30 - 200 mW	200 - 1200 mW
Pulse Energy (Max)	20 J	2 µJ @ 355 nm 10 µJ @ 532 nm		
Stability	± 3%	± 1%	± 2%	± 3%
Spectral Bandwidth	3 - 4 nm FWHM	~1 nm	< 1 nm FWHM	1 - 2 nm FWHM
Pulse Width	3 - 5 ns	~1 ns	1 ms - 10 s	
Pulse Repetition Rate	0 - 20 Hz	0.2 - 5 kHz	1 - 1000 Hz	
Lifetime	20M laser pulses; 30,000 laser pulses per refillable dye cell	5000 hrs typical	5000 hrs typical	
Beam Diameters*				
No objective	9 mm	9 mm	9 mm	9 mm
10X objective	2.8 µm	2.8 µm	16 µm	16 µm
20X objective	1.0 µm	1.0 µm	8 µm	8 µm
40X objective	0.7 µm	0.7 µm	4 µm	4 µm
60X objective	0.6 µm	0.6 µm	3 µm	3 µm
100X objective	0.6 µm	0.6 µm	2 µm	2 µm
Beam Divergence*				
No objective	40 mrad (2.29 degrees full angle)			
10X objective	0.3 NA (25 degrees full angle)			
20X objective	0.8 NA (106 degrees full angle)			
40X objective	1.2 NA (180 degrees full angle)			
60X objective	1.4 NA (180 degrees full angle)			
100X objective	1.4 NA (180 degrees full angle)			
IEC 60825-1 Classification	Class 3B	Class 4	Class 3B	Class 4

Notes:
1. Beam Diameter and Beam Divergence values are at the laser aperture, which is the Microscope Objective Turret Output.
2. IEC 60825-1, ANSI Z136.1 and the FDA's Recognized Consensus Standards (ISO 11146) all use full angle for beam divergence.
3. Numerical Aperture conversion into degrees full angle is for air.
4. 1.0 NA and above will become 180 degrees full angle in air.

Widefield Illumination Port Options

Dichroic Beamsplitter	Single pass, specify wavelength; Multi-pass, specify wavelength Match to laser and EPI requirements
Broadband Beam Splitter (AOI 45 degrees)	450 nm - 750 nm, R = 100, 70, 50 or 30%
Excitation Filter	360 nm / 40 nm (DAPPI); 480 nm / 20 nm (GFP); 470 nm / 40 nm (FITC); 535 nm / 40 nm (Rhodamine)
Microscope Epi Fluorescence Cubes	A wide range of microscope filter cubes is available to combine MicroPoint laser stimulation with imaging on many microscope configurations

Additional illumination port options available on request

Mechanical / Electrical

	MicroPoint 4
Illumination Port Clear Aperture	Ø 34 mm
Illumination Port Filter Size	Ø 38 mm

Mechanical Specifications

	MicroPoint 4
Weight (MicroPoint 4 Controller)	1.6 kg
Dimensions	255 x 200 x 109 mm
Weight (MicroPoint 4 Manual LCD Controller)	0.4 kg
Dimensions	132 x 90 x 47 mm
Weight (Optical Head Nitro FSA Galvo)	1.8 kg/4.1 lb
Weight (Optical Head Manual FSA)	1.4 kg/3.0 lb
Weight (Optical Head Pico FSA Galvo)	2.8 kg/6.2 lb including Pico Laser
Weight (NL100 Nitrogen Laser)	3.4 kg/7.5 lb
ILE 400 CW laser	20 kg/44.1 lb
HLE CW laser	35 kg/77.2 lb

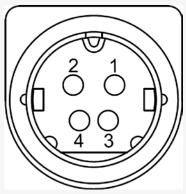
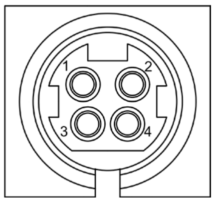
Environmental Specifications

	MicroPoint 4
Location to be Used	Indoor laboratory environment
Altitude	Up to 2000 m
Operating Temperature	18 - 28 °C ambient
Storage Temperature	5 - 40 °C
Operating Relative Humidity	< 70% (non-condensing)
Pollution Degree	Pollution degree 2. Normally only non-conductive pollution occurs. Occasionally, however, a temporary conductivity caused by condensation must be expected.
Cooling Vent Clearance	Do not cover during operation. Allow 200 mm clearance at air vents.

MicroPoint 4 Controller Electrical Power Specifications

	MicroPoint 4 Controller
Mains Input for Supplied External Power Supply	100 - 240 VAC, 50 - 60 Hz
Power Consumption (Typical & Max)	7W with no galvos 21 W with galvos idle 25W with galvos active
Low Voltage Rating	24 V
Low Voltage Supply Current Rating	6.6 A
Mains Overvoltage Category	CAT II An overvoltage category of CAT II means that the equipment is designed to cope with transient voltages above the rated supply that would be experienced by any product connected to a standard single-phase mains socket in a building.

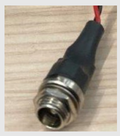
MicroPoint 4 Controller External Power Supply Requirements

	MicroPoint 4
Supplied EPS	PS-29
Low Voltage Supply	24 V ± 5%
Low Voltage Supply Current	1 A
Low Voltage Supply Cable Plug	KYCON KPPX-4P
Low Voltage Supply Cable Plug Insertion View	
Low Voltage Supply Pin Connections	Pins 1 & 2 +24 V Pins 3 & 4 GND
Functional Earth for EMC	0 V Return, cable shield and connector shell are connected to Mains Earth
Low Voltage Supply Product Socket	Kycon KPJX-4S
Low Voltage Supply Product Socket Insertion View	
Ripple	480 mV Max.
Safety	Certified to IEC 62368-1 in accordance with local safety regulations and meets the reinforced insulation from mains requirement of IEC 61010-1
EMC Ferrite	None
Environmental	Ensure that the EPS meets the environmental specification of the overall product

NL100 Nitrogen Laser Electrical Power Specifications

	NL100 Nitrogen Laser
Mains Input for Supplied External Power Supply	100 - 240 VAC, 50 - 60 Hz
Power Consumption (Typical/Max)	36 W/50 W
Low Voltage Rating	24 V
Low Voltage Supply Current Rating	2.1 A
Mains Overvoltage Category	CAT II An overvoltage category of CAT II means that the equipment is designed to cope with transient voltages above the rated supply that would be experienced by any product connected to a standard single-phase mains socket in a building.

NL100 Nitrogen Laser External Power Supply Requirements

	NL100 Nitrogen Laser
Supplied EPS	ELC-04748
Low Voltage Supply	24 V ± 1 V
Low Voltage Supply Current	2.1 A
Low Voltage Supply Cable Plug	2.5 mm ID/ 5.5 mm OD/ 9.5 mm length DC Coaxial Plug
Low Voltage Supply Cable Plug	
Low Voltage Supply Pin Connections	 Centre +12 V Outside Return
Functional Earth for EMC	0 V is connected to Mains Earth
Low Voltage Supply Product Socket	2.5 mm receptacle
Low Voltage Supply Product Socket	
Ripple	< 1% pk-pk
Safety	Certified to IEC 62368-1 in accordance with local safety regulations and meets the reinforced insulation from mains requirement of IEC 61010-1
Environmental	Ensure that the EPS meets the environmental specification of the overall product
EMC Ferrite	None

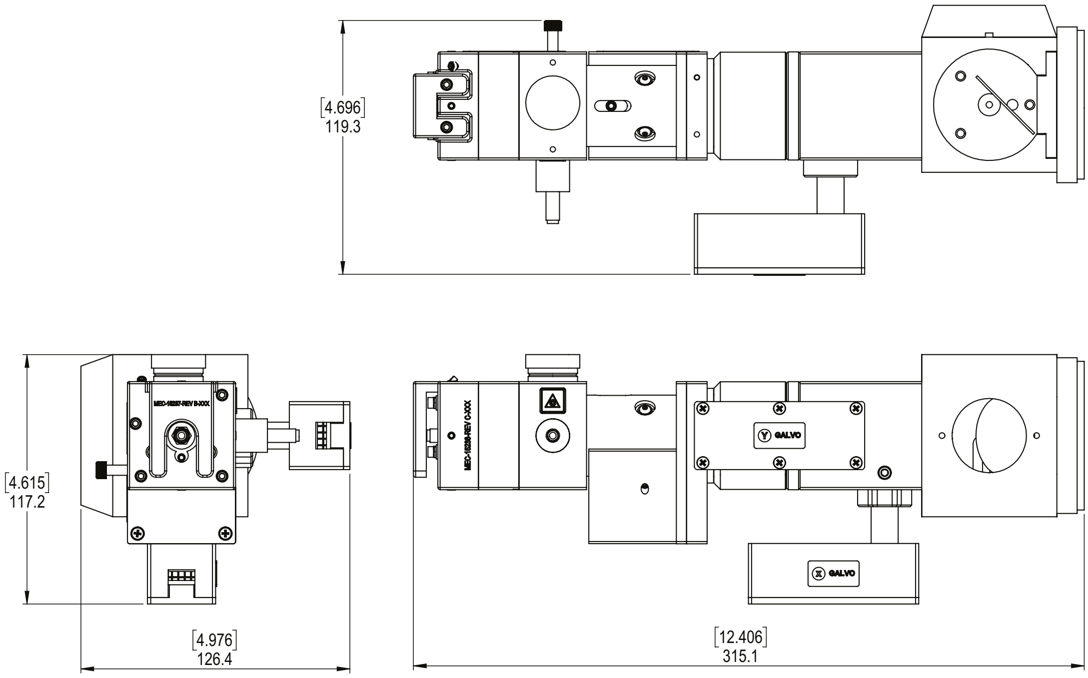
See also user manuals of other components :

Nitro NL100 Laser
Laser-Lock Interlock
ILE Integrated Laser Engine CW laser
HLE High Power Laser Engine CW laser

Appendix B: Mechanical Drawings

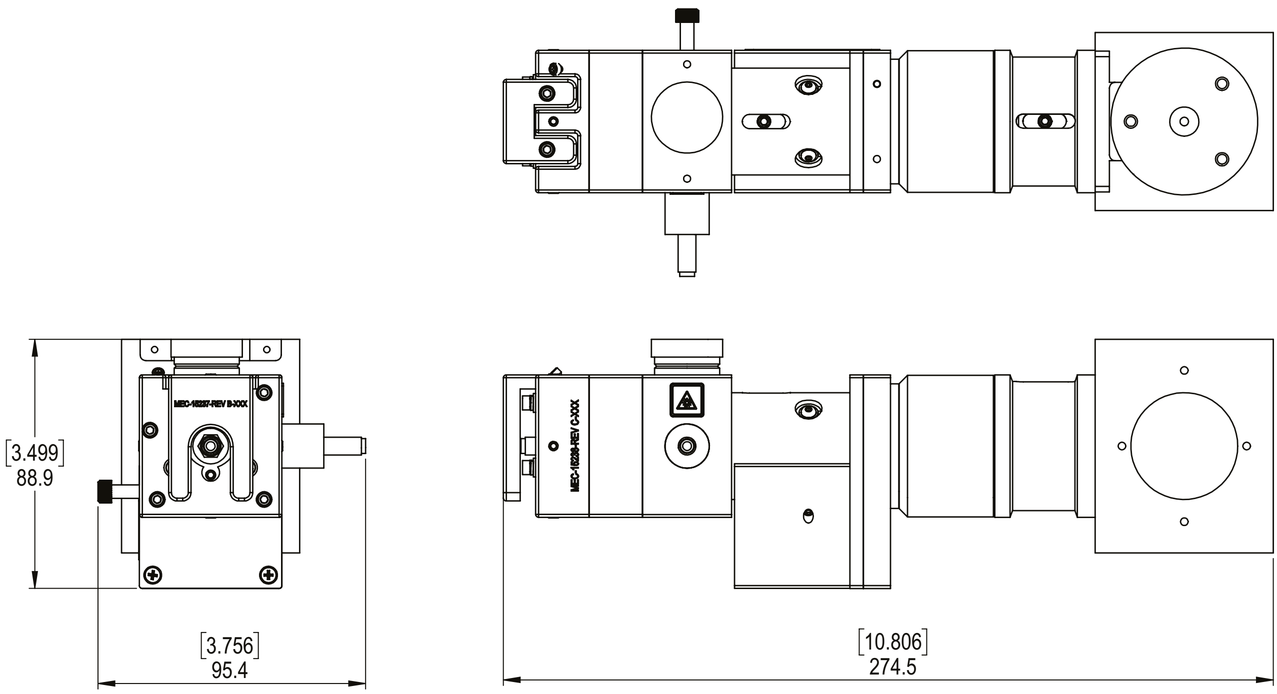
MicroPoint 4 Optical Head Nitro with FSA and Galvo

Weight 1.8 kg 4.1 lbs

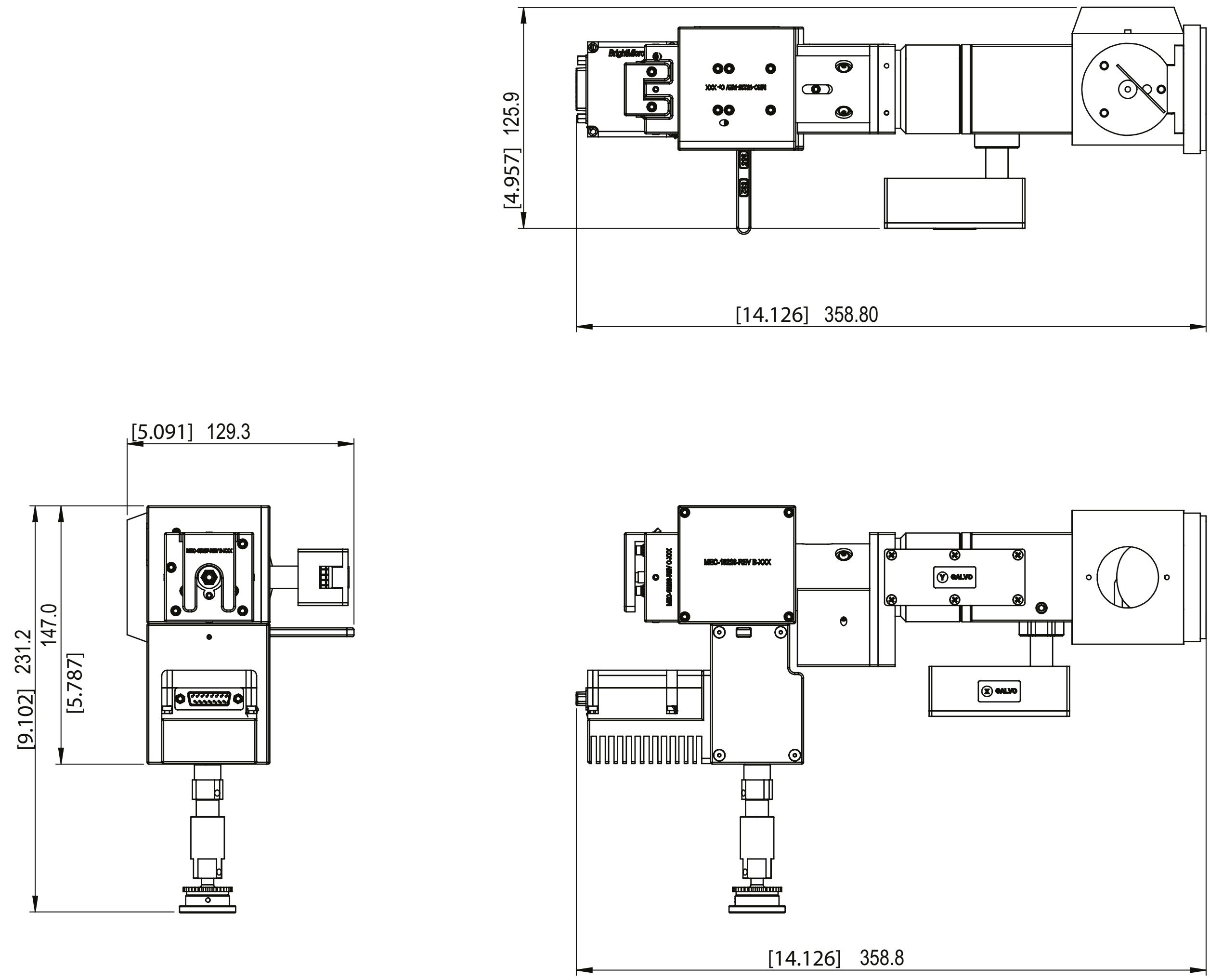


MicroPoint 4 Optical Head Manual version with FSA

Weight 1.4 kg 3.0 lbs

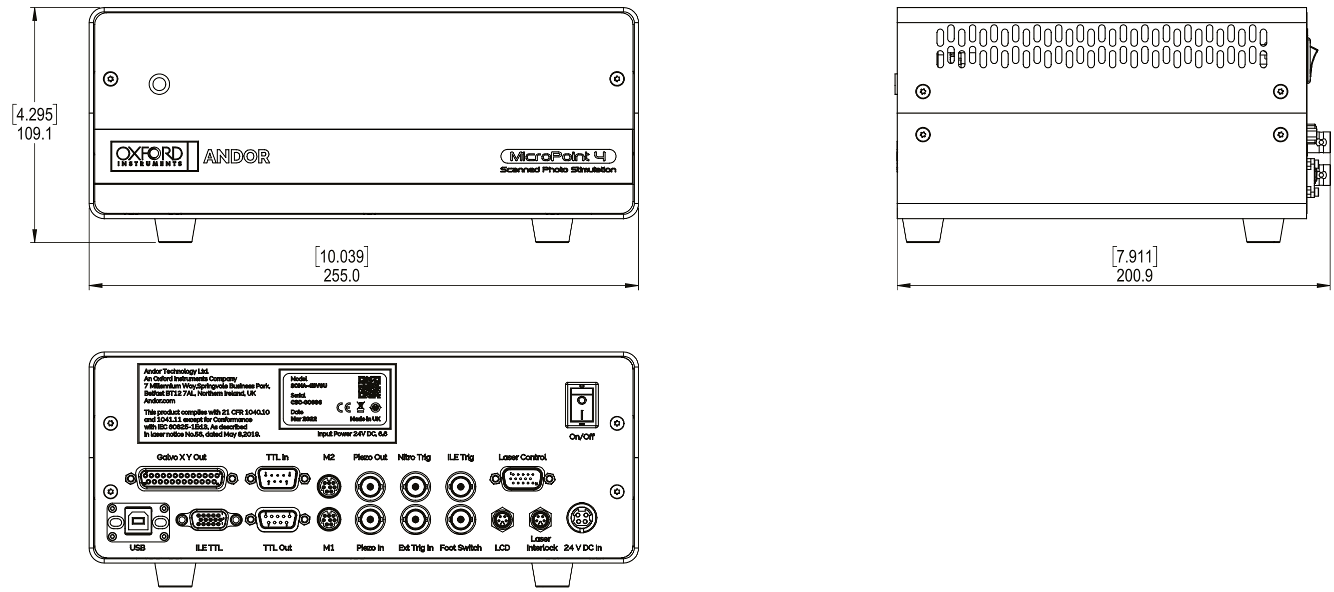


Weight 2.8 kg (6.2 lb)



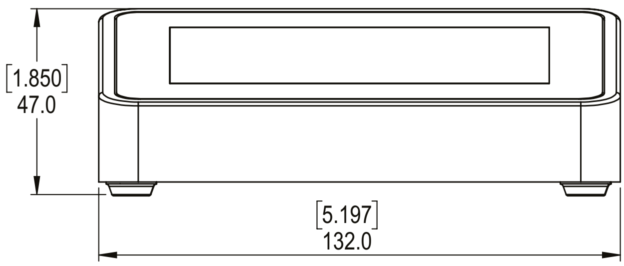
MicroPoint 4 Controller

Weight 1.6 kg (3 lb 3 oz)

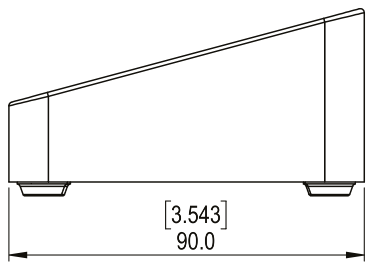


MicroPoint 4 Manual Controller

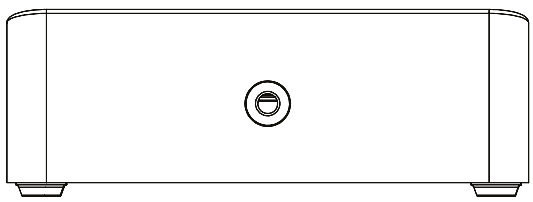
Weight 0.4 kg (12 oz)



FRONT VIEW



SIDE VIEW



REAR VIEW

Appendix C: Other Information

C.1 Terms and Conditions of Sale and Warranty Information

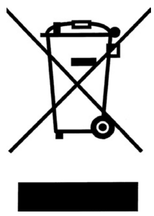
The terms and conditions of sale, including warranty conditions, will have been made available during the ordering process. The current version for the US is available here, for all other regions (except Japan) please click here.

C.2 EU/UK REACH Regulation Statement

Andor's EU/UK REACH Regulation statement is available at the following link.

C.3 Waste Electronic and Electrical Equipment

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



Appendix D: MicroPoint 4 China RoHS Hazardous Substances Declaration

Name and Content of Hazardous Substances in the Product
产品中有害物质的名称及含量 产品中有害物质的名称及含量

Component Name 部件名称	Hazardous Substance: 有害物质					
	Lead (Pb) 铅	Mercury (Hg) 汞	Cadmium (Cd) 镉	Chromium VI Compounds (Cr^{6+}) 六价铬化合物	Polybrominated Biphenyls (PBB) 多溴化联苯	Diphenyl Ethers (PBDE) 多溴联苯醚
Printed Circuit Board Assemblies (Surface-Mount Resistors and Capacitors, Brass Connectors, and ASE-15120 Components CN3, CN4, CN6, FUSE1, FUSE2, FUSE 3, D2, D5, D6, Q7, Q8, U1, U2) (ASE-15120 CN3. CN4 CN6, FUSE1. FUSE2. FUSE 3. D2. D5. D6. Q7. Q8. U1. U2)	X	O	O	O	O	O
ELC-04748 External Power Supply (Inventus FWE050024A-10A) ELC-04748 (Inventus FWE050024A-10A)	X	O	O	O	O	O
PS-29 External Power Supply (PowerPax SW4379; Adapter Tech. ATS160T-P240) PS-29 (PowerPax SW4379; Adapter Tech. ATS160T-P240)	X	O	O	O	O	O
All other parts	O	O	O	O	O	O

This table was developed according to the provisions of SJ/T 11364
本表格依据SJ/T 11364 的规定编制
O - The content of such a hazardous substance in all homogeneous materials of such a component is below the limit required by GB/T 26572
O -表示该有害物质在该部件所有均质材料中的含量均在GB/T 26572 规定的限量要求以下
X - The content of such a hazardous substance in a certain homogeneous material of such a component is above the limit required by GB/T 26572
X - 表示该有害物质至少在该部件的某一均质材料中的含量超出GB/T 26572 规定的限量要求