

Rotr

Version 1.0 rev 18 Feb 2015



Hardware Guide

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REVISION HISTORY

Version	Released	Description
C	21 Jan 2013	Initial Release
1.0	18 Feb 2015	Presentation updated to current. Formatting enhanced throughout.

SAFETY AND WARNING INFORMATION



WARNING: PLEASE READ THIS SAFETY INFORMATION BEFORE USING THIS PRODUCT

1. If the equipment is used in a manner not specified by Andor, the protection provided by the equipment may be impaired.
2. Before using the system, please follow and adhere to all warnings, safety, manual handling and operating instructions located either on the product, supplied documentation, or in this guide.
3. Keep this guide in a safe place for future reference.
4. There are no user-serviceable parts inside the product and the enclosure must not be opened. Only authorised service personnel may service this equipment.
5. This equipment has not been designed and manufactured for the medical diagnosis of patients.
6. Only the correctly specified mains supply should be used.
7. Replacement fuse must be of same type and rating.
8. Only the AC/DC external power supply provided with the product should be used.
9. Only the power supply cord provided with the product should be used. Should this not be correct for your geographical area, contact your local representative.
10. Make sure the power supply cord is located so that it will not be subject to damage. If replacement of the detachable power supply cord is required, ensure replacement is of same type and rating.
11. While running an experiment, try to keep room temperature as stable as possible.
12. Performance of the system may be adversely affected by rapidly changing environmental conditions or operation outside of the operating conditions specified in Technical Specifications.
13. This product is not designed to provide protection from ionising radiation. Any customer using this product in such an application should provide their own protection.
14. This is a Class A product. In a domestic environment this product may cause electromagnetic interference, in which case the user may be required to take adequate measures.
15. This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a non-residential environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at their own expense.
16. Shielded I/O cables must be used when operating this equipment.
17. Pollution Degree 2. Normally only non-conductive Pollution occurs. Occasionally, however, a temporary conductivity caused by condensation must be expected.
18. Your product is a precision scientific instrument containing fragile components. Always handle it with care.
19. Do not wet or spill liquids on the product, and do not store or place liquids on the product.
20. If spillage occurs on the product, switch off power immediately, and wipe off with a dry, lint-free cloth.
21. If any ingress of liquids has occurred or is suspected, unplug the mains cables, do not use, and contact Customer Support.
22. Do not expose the product to extreme hot or cold temperatures.
23. Do not expose the product to open flames.
24. Do not allow objects to fall on the product.
25. Refer to **Section 6.1** for Cleaning information

SECTION 1. INTRODUCTION

Thank you for purchasing an Andor Rotr 10-position filter wheel. You are now in possession of a high speed filter wheel unit, designed for the most challenging microscopy applications.

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

The Rotr is designed to be used in research laboratories and other controlled scientific environments. This manual is aimed at covering the operation and maintenance of the Rotr filter wheel.

This product forms part of the Revolution XD system, and therefore this manual should be read in conjunction with all relevant manuals supplied with your system. Please note that some of the equipment described in this manual may not be included in the set you have purchased.

1.1. 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

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1.2. DISCLAIMER

Andor Technology assumes no liability for the use of the information contained in this document or the software which it describes. The user assumes all risks. There is no warranty of fitness for a particular purpose, either express or implied.

The information contained in this document is assumed to be correct, but in no event shall Andor Technology be held responsible for typographical errors or changes in the software not reflected in this document.

The specifications contained in this document are subject to change without notice.

Any changes or modifications not expressly approved in this manual could void your authority to operate this equipment.

If you require further information about this unit, you may contact your local representative. The latest contact details for your local representative may be found at our website: www.andor.com

1.3. TRADEMARKS

Andor and the Andor logo are trademarks of Andor Technology. Andor Technology is an Oxford Instruments company. All other marks are property of their owners. All other trademarks mentioned in this document are the property of their respective owners, and are used herein solely for informational purposes only.

Changes are periodically made to the product and these will be incorporated into new editions of the manual. New releases of the manual are available through MyAndor: <http://my.andor.com/login.aspx>

SECTION 2. PRODUCT OVERVIEW

2.1. HARDWARE DESCRIPTION

An outline of the basic components of the Rotr are outlined below. Once installed the Rotr is controlled through the software.

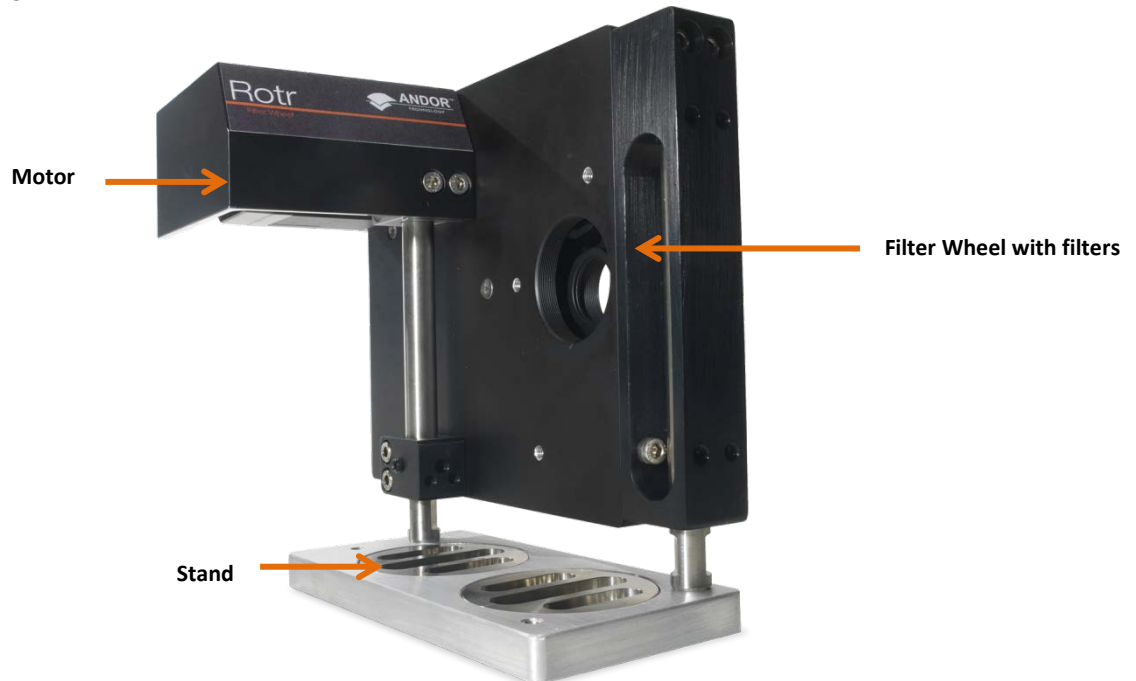


Figure 1. View of the Rotr showing the main hardware features

MOTOR

The enclosed motor rotates the filters between the required filter positions.

FILTER WHEEL

The filter wheel contains up to 10 filters.

STAND

The stand enables the Rotr to be set to the correct optical height and secured to the optical table.

2.2. FILTER WHEEL INTERFACE

The filter wheel interface panel is located on the rear panel of the Rotr.



Figure 2. Rear view of the Rotr showing the location of the connections

A description of these connections is outlined below:



Figure 3. Rotr connections panel

PWR (POWER)

For connection to the 24 V DC power supply unit.

AUX I/O

For connection to an approved suitable shutter (using pins 4 and 7).

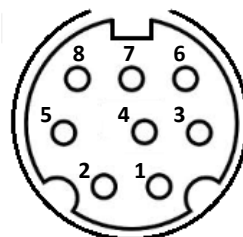


Figure 4. AUX I/O pinouts

OUT

RS-232 connection for connection to additional filter wheels. By using the RS-232 connection you can control up to three high speed filter wheels by daisy-chaining the devices as shown below:

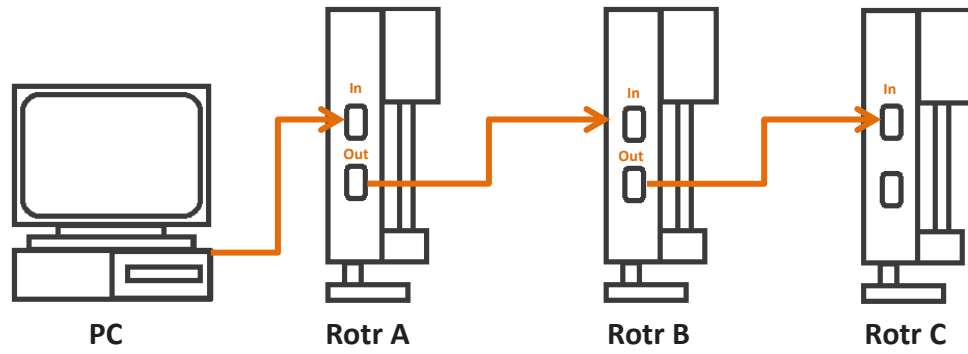


Figure 5. Outline view showing connections for up to 3 Filter wheels

IN

RS-232 connection for connection to the control PC.

SECTION 3. FEATURES AND FUNCTIONALITY OF THE ROTR

3.1. ABOUT THE REVOLUTION SYSTEM

The Revolution XD and WD Systems provide a framework for Andor's laser spinning disk, live-cell confocal microscopy solutions, which combine our award winning iXon Electron Multiplying CCD (EMCCD) camera with the renowned Yokogawa CSU-X1 and CSU-W1.

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

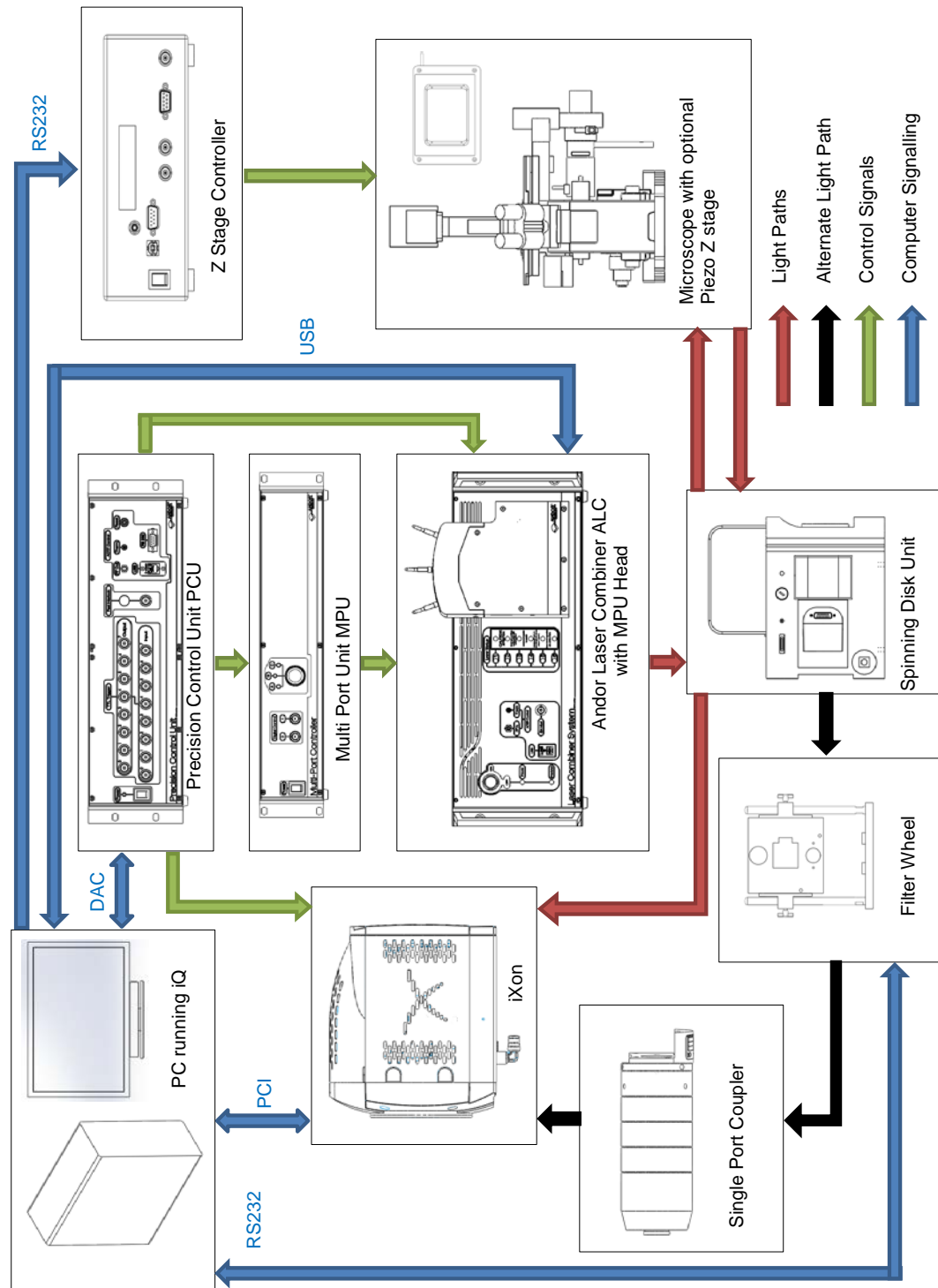


Figure 6. Overview of Rotr integrated into a typical system

3.2. REQUIRED SOFTWARE

To control the Rotr you will need one of the following software packages.

- iQ (available from Andor)
- MetaMorph
- Micro-Manager

3.3. ROTR FILTER WHEEL FUNCTIONS

Rotr filter wheel offers exceptionally high switching speeds, and is mounted at an angle between the CSU and camera for optimum performance with no back reflections.

The Rotr filter wheel has the following functions:

- Houses, powers and controls up to 10 filters of 25mm diameter.
- Is controlled by PC-based software via a RS-232 cable (supplied)
- Controls the filter position and speed of switching.
- Allows the control of up to 3 filter wheels by daisy-chaining the devices.

SECTION 4. INSTALLATION

4.1. INSTALLING THE ROTR FILTER WHEEL

WARNING

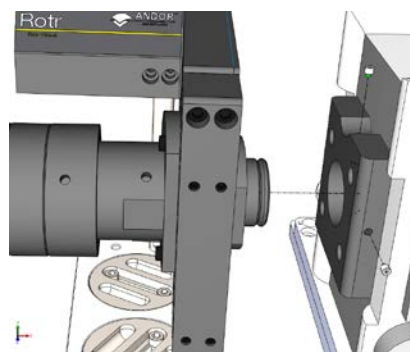
This product is supplied as part of a system, and must be installed by an Andor Installation Technician or a trained Andor Systems distributor. The following is only provided to augment this.

4.1.1. LOCATION AND MOUNTING

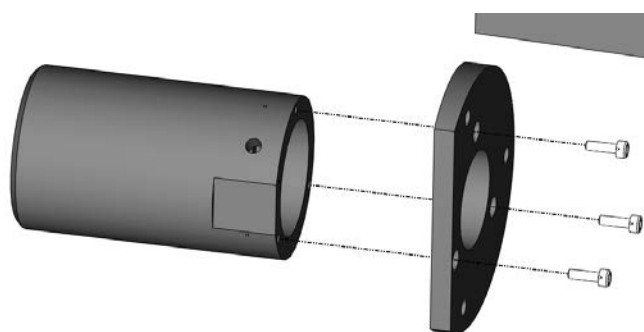
- Temperature and humidity must meet the specifications shown in; Section 7.2 Operating Conditions
- Operational vibrations should be eliminated. Ensure the stand is fully clamped to the optical table, using 2 screws per clamp ring where possible.
- Power cabling and control cables should be routed to prevent accidents, damage and accidental unplugging.

Installation into a Revolution System by an Andor Installation Technician or trained Andor Systems distributor will include the following steps:

1. Attach the Rotr to the CSU using 2 off M4 grub screws.



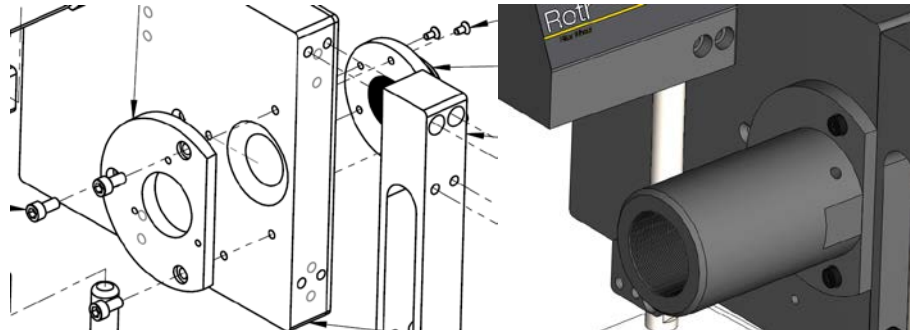
2. Attach the lens adapter to the Rotr adapter plate using 3 off M3 cap head screws.



3. Attach the camera adapter using 3 off M5 nylon tipped grub screws.



4. Attach adapters to the Rotr housing as per Andor Assembly drawing ENI-00766 (For adapter part numbers refer to the sales order BOM).



5. Install the power cable and data cable per the connector IDs on the back of the filter wheel (Section 2.2).

4.1.2. ASSEMBLY

This product itself requires no assembly. Cables connections are covered in Section N.N

4.1.3. POWER CONNECTION AND PROTECTIVE EARTHING

- See Section 5.1 Emergency Disconnection
- Before connection, check that the mains power socket used can provide the power as specified;
- Rotr Section 7.1 Power Supply
- Always switch off power before connecting/ disconnecting cables from the product.
- A mains power cable is provided with this product, but ensure that it satisfies local regulations for safety.
- Mains power is connected via the 3-pin IEC C14 connector on the rear panel of the product.
- An integral part of protection against electric shock in the case of a fault is the protective earth provided via the earth conductors in the mains cable. It is therefore vital that the earth system of the building, and in particular the socket, is constructed properly to provide suitable protection when needed.
- Do not pull cables by the sheath. Use the connector body.

4.2. INSTALLING CABLES

4.2.1. POWER AND SIGNAL CABLING

Refer to Sections 2.2 and 7.1

4.3. INSTALLING THE SOFTWARE

Refer to the Software Guide supplied with your software for details.

SECTION 5. USING THE ROTR FILTER WHEEL

WARNING

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

5.1. EMERGENCY DISCONNECTION

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

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

5.2. INSTRUCTIONS FOR USE

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

5.3. POWER-UP SEQUENCE

1. Power up the Rotr filter wheel. The motor should be audible as the filter wheel is turned to confirm the 0 position filter.
2. Wait 1 minute to allow the Rotr device to stabilise.
3. Power up the workstation.
4. Wait for 5 minutes to allow the system to fully boot up and stabilise.
5. Enable the control software. Please refer to software user manual for operating protocols.
6. Wait for a minimum of 5 minutes before commencing with the experiment.
7. Whilst running an experiment try to keep room temperature as stable as possible.
8. If the system is not required for a while it should be powered down.

5.4. POWER-DOWN SEQUENCE

1. Close down the controlling software; please refer to software user manual for protocols.
2. Wait for software tab to disappear from workstation start bar.
3. Power down the workstation.
4. Power down the Rotr filter wheel.

SECTION 6. MAINTENANCE

PLEASE NOTE the following:

- If the equipment is used in a manner not specified by Andor, the protection provided by the equipment may be impaired.
- In case of emergency, the disconnecting device is the mains lead. This will either be the mains lead connected to the product, or in the case of a cabinet-based system the mains lead to the cabinet. See Section 5.1 Emergency Disconnection.

6.1. CLEANING AND DECONTAMINATION

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

6.2. REGULAR CHECKS

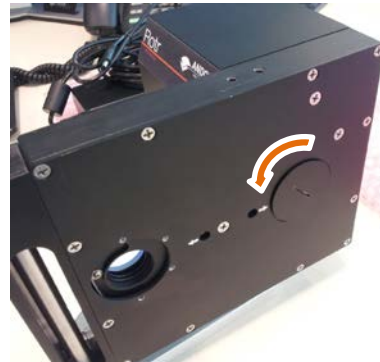
- The state of the product should be checked regularly, especially the integrity of the enclosure and the mains cable.
- Do not use equipment that is damaged.

6.3. ANNUAL ELECTRICAL CHECKS

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

6.4. INSTALLING FILTERS

1. Access to the filters is through the access port as indicated. Using a flat head screwdriver or similar tool unscrew the cover anti-clockwise.



2. Remove the retaining ring using a Thorlabs SPW602 filter tool.



3. Carefully insert the filter, noting the orientation of the filter to suit the image direction (normally arrow toward camera side).



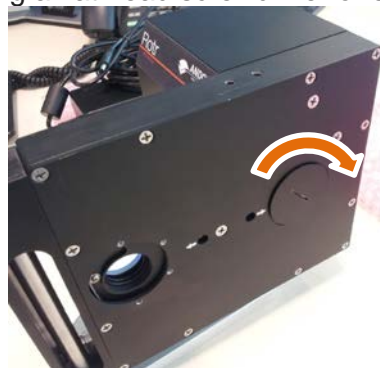
4. Re-install the retaining ring using a Thorlabs SPW602 filter tool. Be careful not to over-tighten once the ring is clamping the filter into the installed position.



5. Ensure the filter is fully retained and has no free play by lightly shaking the filter wheel.



6. Re-install the access panel using a flat head screwdriver or similar tool, and screwing clockwise.



SECTION 7. SPECIFICATIONS

7.1. POWER SUPPLY

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

Parameter	Specification
Voltage Range	24 V DC
Frequency Range	50-60 Hz
Power Rating (max.)	120W

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

7.2. OPERATING CONDITIONS

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

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

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

7.3. MECHANICAL SPECIFICATIONS

Parameter	Specification
Width	136 mm
Height	190mm
Depth	221 mm*
Weight	3 kg max.
Finish	Black anodised
Ingress Protection	IP20†

* Excluding connected cables at rear.

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

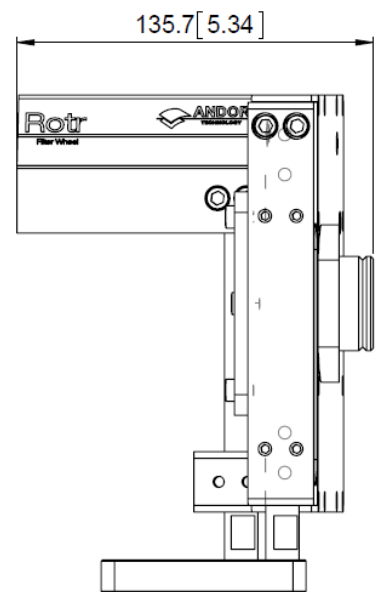
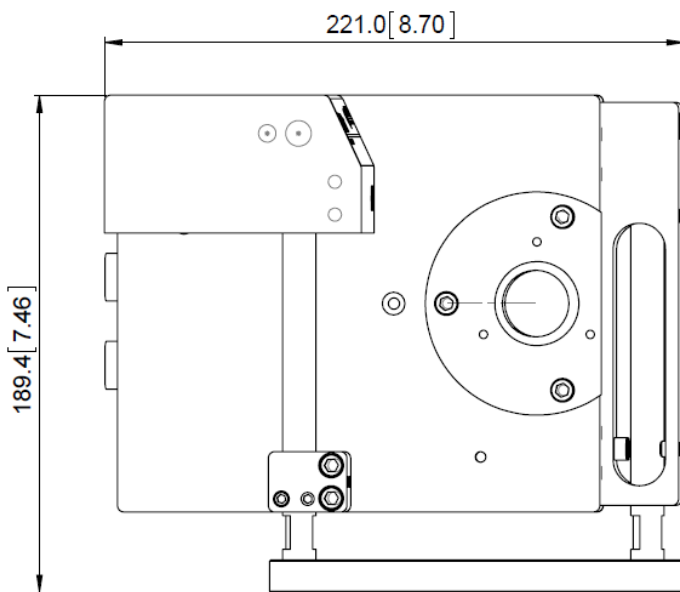
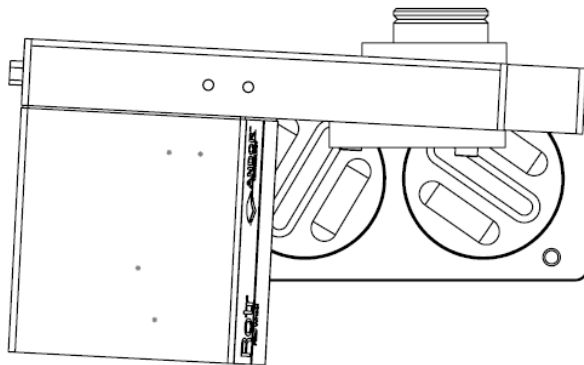
7.4. TRANSPORT & STORAGE SPECIFICATIONS

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

Parameter	Specification
Shipped Dimension	520 x 370 x 220 mm (20.5 x 14.5 x 8.5 inches)
Approximate Shipped Weight	5kg max

APPENDIX A. MECHANICAL DRAWINGS

Dimensions in mm [inches]



APPENDIX B. COMMANDS

GET FILTER WHEEL STATUS

Byte 1: 0xCC

7	6	5	4	3	2	1	0
1	1	0	0	1	1	0	0

Response:

When requesting the wheel status, the device responds with the received command (CC hexadecimal) immediately and requests configuration information from a daisy-chained wheel. The status information of the whole chain is returned after a 1/4s timeout.

Bytes 0-10

0	1	2	3	4	5	6	7	8	9	10
0xCC	WAST	WBST	-	WCST	SAST	SBST	SAMOD	-	SMOD	0x0D

Byte 0: 0xCC

Bit	7	6	5	4	3	2	1	0
Name	1	1	0	0	1	1	0	0

Byte 1: WAST (Wheel A Speed and Position)

Bit	7	6	5	4	3	2	1	0
Name	0	SPD2	SPD1	SPD0	POS3	POS2	POS1	POS0
Description		Wheel speed			Wheel position (0 – 9)			
		000 (0) Speed = 0			0000 (0) Position = 0			
		001 (1) Speed = 1			0001 (1) Position = 1			
		010 (2) Speed = 2			0010 (2) Position = 2			
		011 (3) Speed = 3			0011 (3) Position = 3			
		100 (4) Speed = 4			0100 (4) Position = 4			
		101 (5) Speed = 5			0101 (5) Position = 5			
		110 (6) Speed = 6			0110 (6) Position = 6			
		111 (7) Speed = 7			0111 (7) Position = 7			
					1000 (8) Position = 8			
					1001 (9) Position = 9			

Byte 2: WBST (Wheel B Speed and Position)

Bit	7	6	5	4	3	2	1	0
Name	1	SPD2	SPD1	SPD0	POS3	POS2	POS1	POS0
Description		Wheel speed 000 (0) Speed = 0 001 (1) Speed = 1 010 (2) Speed = 2 011 (3) Speed = 3 100 (4) Speed = 4 101 (5) Speed = 5 110 (6) Speed = 6 111 (7) Speed = 7			Wheel position (0 – 9) 0000 (0) Position = 0 0001 (1) Position = 1 0010 (2) Position = 2 0011 (3) Position = 3 0100 (4) Position = 4 0101 (5) Position = 5 0110 (6) Position = 6 0111 (7) Position = 7 1000 (8) Position = 8 1001 (9) Position = 9			

Byte 4: WCST (Wheel C Speed and Position)

Bit	7	6	5	4	3	2	1	0
Name	1	SPD2	SPD1	SPD0	POS3	POS2	POS1	POS0
Description		Wheel speed 000 (0) Speed = 0 001 (1) Speed = 1 010 (2) Speed = 2 011 (3) Speed = 3 100 (4) Speed = 4 101 (5) Speed = 5 110 (6) Speed = 6 111 (7) Speed = 7			Wheel position (0 – 9) 0000 (0) Position = 0 0001 (1) Position = 1 0010 (2) Position = 2 0011 (3) Position = 3 0100 (4) Position = 4 0101 (5) Position = 5 0110 (6) Position = 6 0111 (7) Position = 7 1000 (8) Position = 8 1001 (9) Position = 9			

Byte 5: SAST (Shutter A State)

Bit	7	6	5	4	3	2	1	0
Name	1	1	0	1	1	SHST2	SHST1	SHST0
Description						Shutter state 010 (1) Open 011 (2) Open on ext. trigger 100 (3) Closed		

Byte 6: SBST (Shutter B State)

Bit	7	6	5	4	3	2	1	0
Name	1	1	0	1	1	SHST2	SHST1	SHST0
Description						Shutter state 010 (1) Open 011 (2) Open on ext. trigger 100 (3) Closed		

Byte 7: SAMOD (Shutter A Mode)

Bit	7	6	5	4	3	2	1	0
Name	1	1	0	1	1	SMOD2	SHMOD1	SHMOD0
Description						Shutter Mode 011 (3) Not Connected 100 (4) Normal operation		

Byte 9: SAMOD (Shutter B Mode)

Bit	7	6	5	4	3	2	1	0
Name	1	1	0	1	1	MOD2	SHMOD1	SHMOD0
Description						Shutter Mode 011 (3) Not Connected 100 (4) Normal operation		

GET FILTER WHEEL CONFIGURATION

Byte 1: 0xFD

7	6	5	4	3	2	1	0
1	1	1	1	1	1	0	1

Response:

When requesting the wheel configuration, the device responds with the received command (FD hexadecimal) immediately and requests configuration information from a daisy-chained wheel. The configuration information of the whole chain is returned after a 1/4s timeout.

Bytes 0 – 4

0	1	2	3	4
0xFD	'1'	'0'	'-'	'3'

Bytes 5 – 9

5	6	7	8	9
'W'	'A'	'.'	WHLACFG	
			Wheel A configuration 'NC' Not Connected 'ER' Error '25' 25mm '32' 32mm	

Bytes 10 - 14

10	11	12	13	14
'W'	'B'	'.'	WHLACFG	
			Wheel B configuration 'NC' Not Connected 'ER' Error '25' 25mm '32' 32mm	

Bytes 15 - 19

15	16	17	18	19
'W'	'C'	'.'	WHLCCFG	
			Wheel ~C configuration 'NC' Not Connected 'ER' Error '25' 25mm '32' 32mm	

Bytes 20 - 24

20	21	22	23	24
'S'	'A'	'.'	SHATYP	
			Shutter A Type 'VS' Vincent Shutter	

Bytes 25 - 29

25	26	27	28	29
'S'	'B'	'.'	SHBTYP	
			Shutter B Type 'VS' Vincent Shutter	

Bytes 30

30

SET WHEEL POSITION

Byte 1: 0xFC

7	6	5	4	3	2	1	0
1	1	1	1	1	1	0	0

Byte 2:

Bit	7	6	5	4	3	2	1	0
Name	WHL	SPD2	SPD1	SPD0	POS3	POS2	POS1	POS0
Description	Wheel selection		Wheel speed		Wheel position (0 – 9)			
	0 Wheel A, C	000 (0) Speed = 0	0000 (0) Position = 0		0001 (1) Position = 1			
	1 Wheel B	001 (1) Speed = 1	0010 (2) Speed = 2		0011 (3) Position = 3			
		010 (2) Speed = 2	011 (3) Speed = 3		0100 (4) Position = 4			
		100 (4) Speed = 4	101 (5) Speed = 5		0101 (5) Position = 5			
		101 (5) Speed = 5	110 (6) Speed = 6		0110 (6) Position = 6			
		110 (6) Speed = 6	111 (7) Speed = 7		0111 (7) Position = 7			
		111 (7) Speed = 7			1000 (8) Position = 8			
					1001 (9) Position = 9			

Response:

Byte 1: command byte as received, returned immediately

Byte 2: 0x0D after task completion

SET SHUTTER STATE

	Open	Open on Ext. Trig	Close
Wheel A	0xAA	0xAB	0xAC
Wheel B	0xBA	0xBB	0xBC

Byte 1:

Bit	7	6	5	4	3	2	1	0
Name	1	0	WHL1	WHL0	1	SHFUN2	SHFUN1	SHFUN0
Description			Wheel selection 10 (2) wheel A 11 (3) wheel B			Shutter state 010 (2) open 011 (3) open on ext. trigger 100 (4) close		

Response:

Byte 1: command byte as received, returned immediately

Byte 2: 0x0D after task completion

RESET

Byte 1: 0xFB

7	6	5	4	3	2	1	0
1	1	1	1	1	0	1	1

Response: 0x0D

EXAMPLES

Binary	Hexadecimal	Decimal	Functionality
00000000	00	0	Wheel A moves to position '0' at maximum speed
10000000	80	128	Wheel B moves to position '0' at maximum speed
11111100	FC	252	Wheel C moves to position '0' at maximum speed
00000000	00	0	
00110110	36	54	Wheel A moves to position '6' at speed 3
10101010	AA	170	Shutter A opens
10101100	AC	172	Shutter A closes
10111010	BA	186	Shutter B opens

APPENDIX C. OTHER INFORMATION

TERMS AND CONDITIONS OF SALE AND WARRANTY INFORMATION

The terms and conditions of sale, including warranty conditions, will have been made available during the ordering process. The current version may be viewed at:

http://www.andor.com/pdfs/literature/Andor_Standard_Warranty.pdf

WASTE ELECTRONIC AND ELECTRICAL EQUIPMENT REGULATIONS 2006 (WEEE)

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

