

Manual for Q/N Series 2D Post-Scanning System



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Content

Summary	1
Manual Description	1
Overview	1
Product Configuration	1
Product Labels	2
Naming Rules	2
List And Specifications Optional Of Systems	3
Instructions For Use	4
System Structure	4
Principles Of Operation	5
System Component Requirements	6
Installation	7
Installation Guide	7
Set Up For Initial Use	11
Cooling Fittings	12
Trouble Shooting	13
Laser Safety	14
Optical Safety	15
Maintenance	16
After-Sales Service	18

Summary

Manual Description

This manual introduces the principles and operation methods of RAY- MOTION's Q/N series 2D galvo scanning system.

Please read this manual carefully before using these devices. If you have any questions please contact us.

RAY-MOTION reserves the right to update this manual at any time without notice.

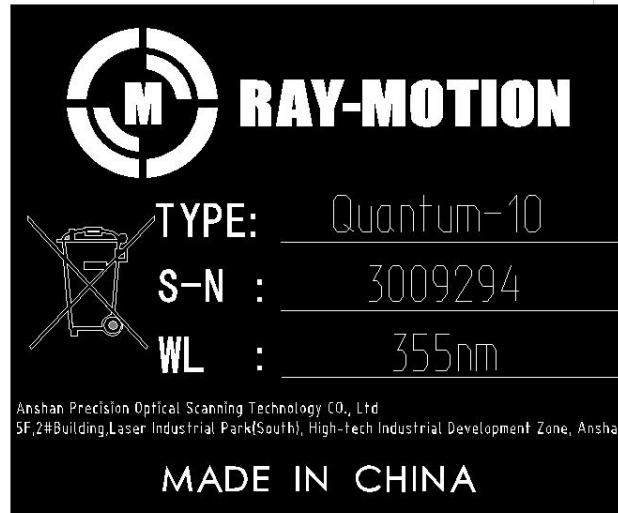
Overview

The Q/N series galvo scanning system is designed for 2D scanning. It includes input aperture models of 10mm, 12mm, 14mm, 20mm, 30mm and 50mm. Cooling can be added to stabilize the system temperature.

Product Configuration

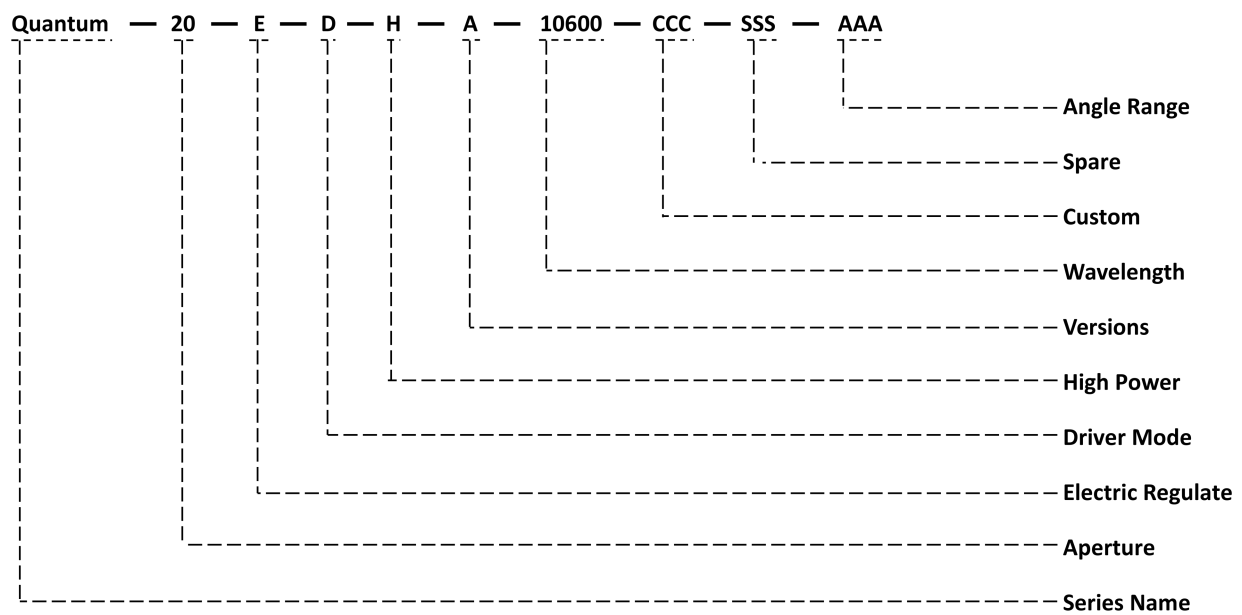
To determine the configuration of your product, refer to the product label located on the back of the galvo, which contains the model name of the product, the compatible laser wavelength (λ) of the galvo, and the factory serial number (SN).

Product Labels



Naming Rules

RAY-MOTION 2D Scanner naming rules:



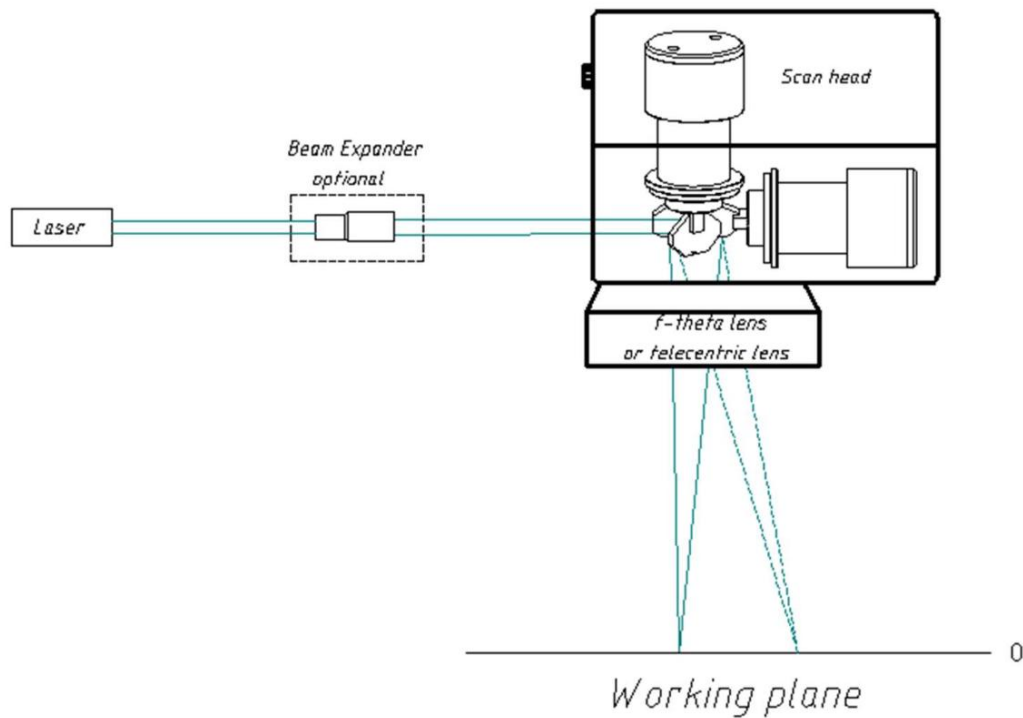
List And Specifications Optional Of Systems

Type	Model
2D Post-Scanning	Atom 10 Series
	Quantum 10 Series
	Quantum 14 Series
	Quantum 20 Series
	Quantum 30 Series
	Neutron 14 Series
	Neutron 20 Series ^{air}
	Neutron 30 Series ^{air}

Instructions For Use

System Structure

The optical configuration is shown in the figure below



The laser output beam is expanded by a beam expander, deflected by two deflectable mirrors, and finally focused on the marking plane by F-theta lens.

The galvo aperture configuration should be carefully selected based on laser power, focus diameter, and dynamic performance.

Principles Of Operation

The 2D galvo scanning system consists of two galvo motors with mirrors.

Galvo motors can be rotated at a limited angle, and they are fixed in a specific position (as shown in the figure above). Therefore, the galvo can be used to deflect the laser beam in the X and Y directions, forming a region. In this area the laser can be pointed at any location, the area is named the marked area, after which the laser can be focused to a point through the F-Theta lens or telecentric lens.

System Component Requirements

You will need the following components to build a laser system for the RAY-MOTION galvo.

No.	Parts	instruction
1	Power supply(AC220V)	Used for power supply of laser and computer
2	Power supply(DC \pm 15v)	For the power supply of the galvo
3	Lasers	Used to output lasers
4	Beam adjustment device	Such as beam expanders, collimators, etc
5	Mounting plate	For connecting fixed RAY-MOTION galvo
6	Install hardware	4 \times M5 Screws, 2 \times 4mm dowel Pin
7	RAY-MOTION galvo	Used to control laser deflection
8	F-theta Lens adapter ring	Used to connect the field mirror to the galvo
9	F-theta Lens	For laser focus
10	System Controller	used to output the control signal of the galvo and laser with the computer
11	PC	For controlling galvo and lasers
12	Power Cord/Data Cable	Used to connect the system controller to the computer
13	Cooling Equipment*	Air-cooled or liquid-cooled equipment for temperature control

14	Work Protection*	Air knife, inert gas environment, etc.
Remark	* Marked parts are non-primary and are added selectively based on requirements and equipment capabilities.	

Installation

Installation Guide

Note

The scanning system must be mounted on a suitable support surface. The support surface should be flat and not affected by mechanical vibration.

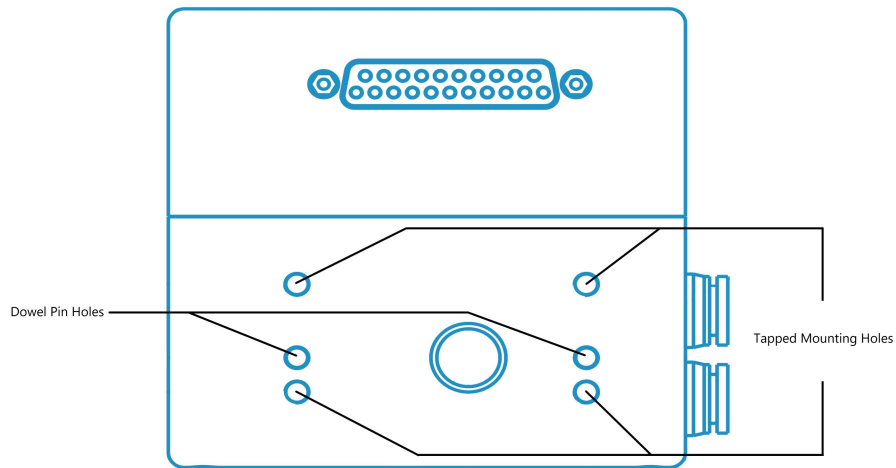
1) Open the RAY-MOTION galvo package

After receiving this product, carefully unpack the contents of the box (check the contents according to the packaging list included with the equipment), carefully remove the galvo from the packaging, remove all the galvo dustproof items, and check whether all components are complete and available.

- ① Protects the galvo from dust and other contaminants.
- ② Save shipping containers and packaging material in case you need to return them for repairs, and the original packaging can better protect the product.

2) Install the galvo

Mount the galvo to the mounting plate with mounting hardware, which has 2 Pin holes and 4 tapping mounting holes.

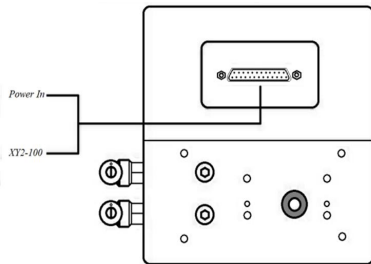


3) Connect the galvo

In the case of power off, use the power/data cable to connect the RAY-MOTION galvo to the system controller, the power supply and signal are set in a D-SUB25 female, the power supply specification is $\pm 15V$, the maximum peak current is 10A, and the digital signal protocol defaults to XY2-100.

It is recommended to verify the supply voltage before connecting the cable to the galvo, it is important to use the correct voltage, and using a voltage higher than the specified voltage may damage the machine.

The figure below depicts the distribution of the galvo power supply pins.



Pin	Name	Signal description	In/Out
1/14	CLOCK-/CLOCK+	CLOCK:Continuously running clock	Input
2/15	SYNC-/SUNC+	SYNC:Synchronises data transfer	Input
3/16	CHAN1-/CHAN1+	CHANNELX:Data to X axis	Input
4/17	CHAN2-/CHAN2+	CHANNELY:Data to Y axis	Input
5/18			
6/19			
7/20			
8/21			
9/10/22	POWER+	+15V	Input
11/23/24	GND		Input
12/13/25	POWER-	-15V	Input

Note

- All related control devices must be turned off before connecting to scan the system.
- The scanning system does not support hot plug.
- The access power signal cable should be shielded.
- The pin GND must be grounded to avoid signal interference.

4)Power on the galvo

Before plugging in the power, confirm that you have configured the system controller correctly to work with your laser, and after you have configured the controller and verified the controller's functionality, you can power on the galvo.

5)Install F-Theta lens and the required lens adapter ring

Installing lens and adapter rings suitable for the galvo band to eliminate the destructiveness of major or minor reverse reflections from the optics to the scanning galvo surface is critical to both scanning performance and galvo safety. When installing an F-Theta lens, make sure your laser is powered off..

6)Align the galvo with the laser

To reduce the risk of injury, please follow the laser safety guidelines in this section.



Never stare at the laser's beam, place any part of your body on the beam path, or expose yourself to the reflections of the beam, RAY-MOTION recommends that you completely enclose and lock the danger zone to prevent possible beam shifts when the laser is energized.

7)Galvo correction

Each controller manufacturer has a specific correction procedure to eliminate any distortion caused by the position of the lens and galvo relative to the working area, distortion caused by the position of the lens and galvo relative to the working area. In the case of using the RMC2 controller, you will use RAY-MOTION's CorrectionWizard software and follow the procedures in the CorrectionWizard manual and correction application notes.

At this point, the installation of the galvo is complete.

Set Up For Initial Use

The setting of the delay parameters is variable because the requirements and controllers used for each application fluctuate.

Use the delay settings listed in the following table as a starting point, then fine-tune the settings as needed.

RECOMMENDED DELAY SETTINGS FOR INITIAL USE

Parameter Name	Parameter index
Laser On	Laser-dependent
Laser Off	Laser-dependent
Mark Delay	130 μ s
Jump Delay	260 μ s
Poly Delay	65 μ s

This parameter is a universal recommended parameter, and should be adjusted according to the actual effect in order to achieve a better marking effect.

If you have any issues or questions while completing these steps, please contact RAY-MOTION.

Cooling Fittings

The Q/N series scanning system can add liquid cooling to conduct the heat generated by the drive and laser injection. The user needs to install the appropriate liquid cooling equipment to ensure the supply cycle of the coolant.

Select the appropriate fittings and hoses to connect the Q/N system to the liquid cooling equipment at a water temperature of not more than 30° C and a maximum pressure of 3 bar.

The coolant can be water with preservatives.

The coolant should not contain copper ions and other heavy metal ions, otherwise it will exacerbate the corrosion of the cooling pipe.

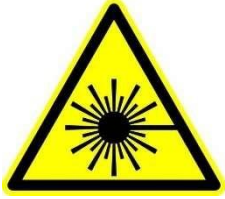
Some models are equipped with a lens air cooling device, and the air cooling interface and function are subject to the actual configuration (optional equipment equipped with air cooling has the "XXX^{air}" logo in the "Optional System List and Specifications").

Trouble Shooting

The following table outlines common problems that users encounter when using galvo, and completes the recommended actions to resolve them. If you need more help, please contact RAY-MOTION.

Symptom	Possible Cause	Recommended Action
Head does not create any marks	Lens is out of focus	Verify that the lens is set at the proper working distance
	Laser is disconnected	Verify that all cables and wires are connected
	Beam path is blocked	Verify that the beam path is clear
Head only marks a spot in the center of the field	No command data is going to the head	1)Verify that all cables and wires are connected 2)Check continuity and verify pinout of power/data cable
Head only marks a spot in a random location of the field	No power is going to the head	1)Verify that all cables and wires are connected 2)Check voltage of cable providing power to the scan head. 3)Check continuity and verify pinout of power/data cable
Low laser power	Optics are dirty or damaged	Inspect all optical surfaces for dirt or damage
	The controller parameters have changed	Verify the laser parameters in the software; correct parameters as needed.
	Laser is aging	Confirm that laser output corresponds with expectations according to the age of laser
	Optics have incorrect coatings	Verify transmission of optics with a laser power meter

Laser Safety



Warning:

Laser beam can cause serious damage to the eyes and skin.

Ensure that the laser is turned off and that misoperation operation is available before operation.

Operators must pass laser safety-related training and wear protective equipment.

Before installing the system, it is important to understand all applicable rules and regulations for the safe operation of the laser. RAY - MOTION is not responsible for the customer's lasers and the entire system.

- a. Debug the laser path using a laser level not higher than 2.
- b. Enclose the entire laser path to block laser radiation.
- c. The laser warning symbol must be placed on the system. (Refer to IEC 60825-1 laser product safety requirements)
- d. During installation and operating system, do not look directly at the laser beam or its deflection radiation. Keep all parts of the body away from the laser beam and its deflection radiation range.
- e. Before daily maintenance, ensure that the laser, QP/NP series scanning system, and controller are turned off.
- f. Always wear appropriate goggles.

Optical Safety

- a. Do not touch the optics and lens with your hands.
- b. Optics may contain toxic substances. If the lens is damaged, do not touch or suck in dust with your hands.
- c. Optics should be cleaned using a mixture of 6:4 acetone and methanol in an appropriate manner.

Maintenance

Due to the special method of equipment commissioning, the maintenance service of the equipment will be provided exclusively by RAY-MOTION.

For after-sales service, please contact us.

www.ray-motion.com

Warning:



Laser beam can cause serious damage to the eyes and skin.

Before cleaning, make sure that the laser is turned off and that the misoperation guard is available.

Relevant personnel must pass laser safety-related training and wear protective equipment.

Dirty optics increase the absorption of laser power by the optical surface.

Dust, droplets and other contaminants in the air can distort the laser beam, causing damage to optical components or other indirect losses.

The company's promised warranty does not include any equipment damage caused by incorrect use methods, improper cleaning or handling methods, at which time the repair and maintenance costs will be borne by the customer.

All optics are sealed in a double-shell kit to protect the optics from dust contamination.

In principle, any form of contamination of the optical system should be avoided as much as possible, but it is difficult to completely avoid it in the actual use process, so it is necessary to clean the optical system with appropriate cycles. Regular inspection and cleaning of optical surfaces can effectively prevent permanent damage.

Optical cleaning instructions: If the optical component is contaminated by the marking process (such as being burned by splashed particles), some solvents (such as acetone, ethanol, propanol, hexane, etc.) can be prepared as follows:

- a. Wear clean gloves, loosen the fixing screws and remove the device.
- b. Blow the dust clearly with rubber skin.
- c. Use a cotton swabs to remove debris.
- d. Use mirror wipe paper to drag and drop to clean up.
- e. Clean again with a cotton swab stained with a small amount of the above solution, with a little force.
- f. Clean the edges of the lens.
- g. Clean up other parts.

After-Sales Service

All maintenance and repairs must be provided by RAY-MOTION.

Before the equipment is serviced and repaired, the customer need to contact RAY-MOTION to ensure that the process is carried out properly.

RAY-MOTION is responsible for the cost of mailing equipment for repairs and maintenance.

The customer is responsible for the cost of sending the equipment back to RAY-MOTION.

Contact details are as follows:

RAY-MOTION

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Atom Specifications

亚腾 规格参数

所有角度均为光学角(All angles are in optical degrees)

Atom10	
输入光束孔径 Aperture	10mm
光束偏移 Beam displacement	13mm
追踪时间 Tracking error time	220us
零点漂移 Offset drift	50urad/K
增益漂移 Gain drift	75ppm/K
阶跃响应时间 Step response time	
1% 全范围响应时间 1% of full scale	0.3ms
10%全范围响应时间 10% of full scale	0.8ms
标记速度 Marking speed ⁽¹⁾	2m/s
定位速度 Positioning speed	12m/s
书写速度 Writting speed ⁽²⁾	
Good quality	500cps
High quality	450cps
可重复性 Repeatability	< 22urad
8小时以上长期漂移 Drift over 8 hours	< 0.3mrad
(环境温度恒定且接有水冷系统 After 30min warm-up and with water cooling)	
标准扫描角度 Typical scan angle	40 degrees
接口协议 Interface ⁽³⁾	XY2-100 Enhanced
工作环境温度 Operating temperature	25±10℃
额定电源容量 Power requirements	±15V DC, 150W
驱动方式 Driver mode	Digital
位置分辨率 Resolution	16Bit
最大激光功率 Max laser power ⁽⁴⁾	100W

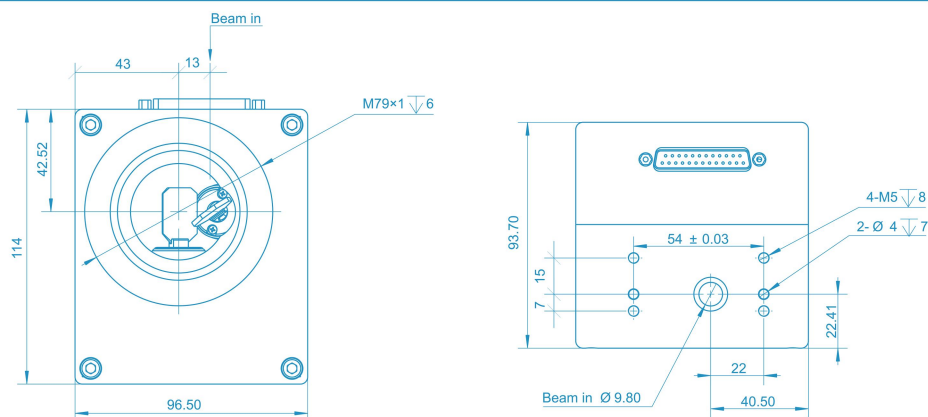
(1)with F-Theta objective,f=160mm

(2)single-stroke characters of 1mm height

(3)XY2-100 Enhanced with status feedback

(4)The mirror of 1064nm can stand max laser power

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Quantum Specifications

昆腾 规格参数

所有角度均为光学角(All angles are in optical degrees)

	Quantum10	Quantum12	Quantum14
输入光束孔径 Aperture	10mm	12mm	14mm
光束偏移 Beam displacement	13mm	14.5mm	18.1mm
追踪时间 Tracking error time	120us	160us	200us
零点漂移 Offset drift	30urad/K	30urad/K	30urad/K
增益漂移 Gain drift	50ppm/K	50ppm/K	50ppm/K
阶跃响应时间 Step response time			
1% 全范围响应时间 1% of full scale	0.3ms	0.3ms	0.5ms
10% 全范围响应时间 10% of full scale	0.8ms	0.8ms	1ms
标记速度 Marking speed ⁽¹⁾	2.5m/s	2m/s	2m/s
定位速度 Positioning speed	15m/s	11m/s	8m/s
书写速度 Writting speed ⁽²⁾			
Good quality	800cps	660cps	550cps
High quality	500cps	410cps	350cps
可重复性 Repeatability	<15urad	<15urad	<15urad
8小时以上长期漂移 Drift over 8 hours	<0.1mrad	<0.1mrad	<0.1mrad
(环境温度恒定且接有水冷系统 After 30min warm-up and with water cooling)			
标准扫描角度 Typical scan angle	40 degrees	40 degrees	40 degrees
最大激光功率 Max laser power ⁽³⁾	100W	150W	200W
接口协议 Interface ⁽⁴⁾ (optional)	XY2-100/XY2-100-EH		
工作环境温度 Operating temperature	25±10℃		
额定电源容量 Power requirements	±15V DC, 150W		
驱动方式 Driver mode	Digital		
位置分辨率 Resolution	16Bit		

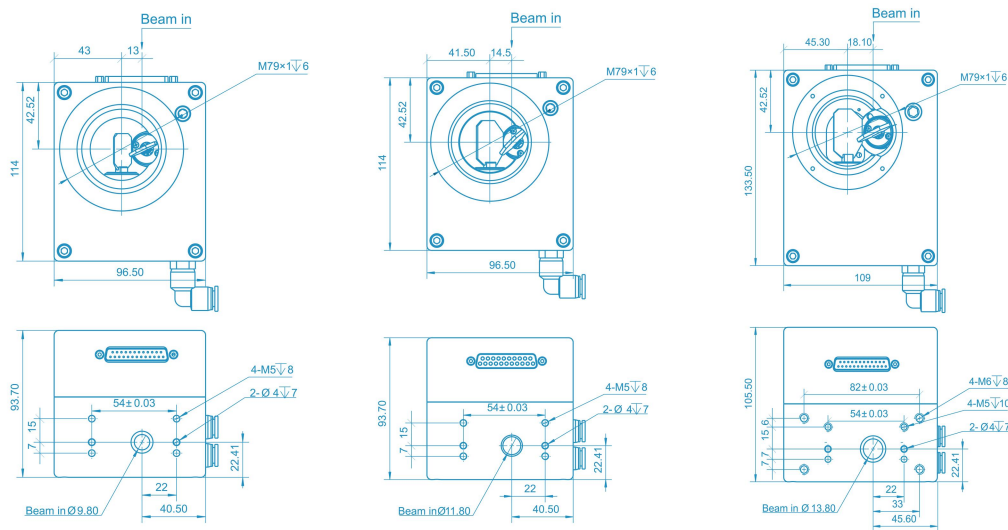
(1)with F-Theta objective,f=160mm

(2)single-stroke characters of 1mm height

(3)The mirror of 1064nm can stand max laser power

(4)XY2-100-EH with status feedback

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Quantum Specifications

昆腾 规格参数

所有角度均为光学角(All angles are in optical degrees)

	Quantum20	Quantum30	Quantum50
输入光束孔径 Aperture	20mm	30mm	50mm
光束偏移 Beam displacement	26.5mm	36mm	55mm
追踪时间 Tracking error time	360us	550us	1.8ms
零点漂移 Offset drift	30urad/K	30urad/K	30urad/K
增益漂移 Gain drift	50ppm/K	50ppm/K	50ppm/K
重量 Weight	4.9kg	6.5kg	7.5kg
阶跃响应时间 Step response time			
1% 全范围响应时间 1% of full scale	-	-	-
10%全范围响应时间 10% of full scale	-	-	-
标记速度 Marking speed ⁽¹⁾	1m/s	0.7m/s	0.7m/s
定位速度 Positioning speed	6m/s	3m/s	1.2m/s
书写速度 Writting speed ⁽²⁾			
Good quality	320cps	220cps	-
High quality	210cps	150cps	-
可重复性 Repeatability	<15urad	<15urad	<15urad
8小时以上长期漂移 Drift over 8 hours	<0.1mrad	<0.1mrad	<0.1mrad
(环境温度恒定且接有水冷系统 After 30min warm-up and with water cooling)			
标准扫描角度 Typical scan angle	40 degrees	40 degrees	40 degrees
最大激光功率 Max laser power ⁽³⁾	1000W	2500W	>2500W
接口协议 Interface ⁽⁴⁾ (optional)	XY2-100/XY2-100-EH		
工作环境温度 Operating temperature	25±10℃		
额定电源容量 Power requirements	±15V DC, 150W		
驱动方式 Driver mode	Digital		
位置分辨率 Resolution	16Bit		

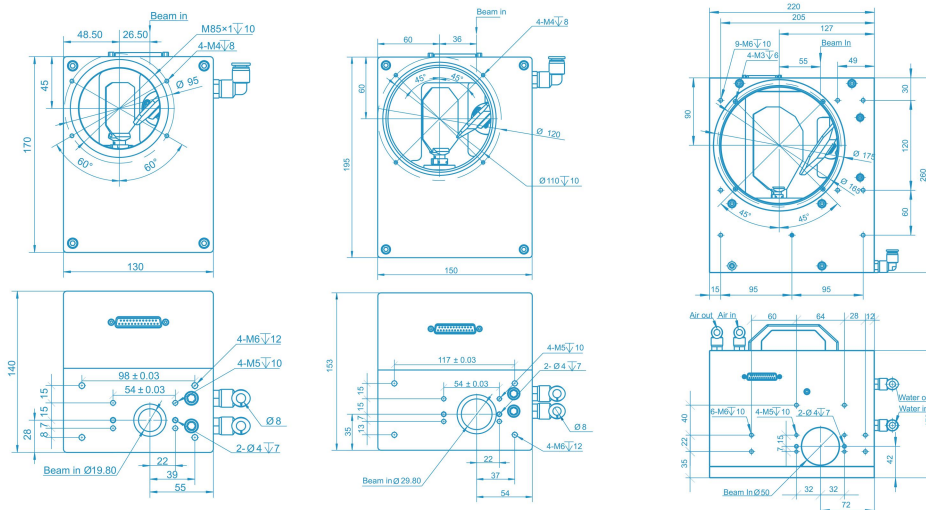
(1)with F-Theta objective,f=160mm

(2)single-stroke characters of 1mm height

(3)The mirror of 1064nm can stand max laser power,with air cooling.

(4)XY2-100-EH with status feedback

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凌腾 规格参数

所有角度均为光学角(All angles are in optical degrees)

(1)with F-Theta objective, $f=160\text{mm}$

(2) Single-stroke characters of 1mm height

(3)The mirror of 1064nm can stand max laser power in air cooling

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Revision History

Tip: The page numbers may appear differently for different versions, depending on the latest version.

Versions	Date	Attribute
1.0.a	2022.1	<ul style="list-style-type: none"> • Initial Version
1.0.d	2022.6	<ul style="list-style-type: none"> • Add System component requirements • Add installation guide • Add initial use settings • Add trouble shooting