

# MOVIA, 2-Axis Scan Head

## User Manual



Read carefully before using.  
Retain for future reference.

ENGINEERED BY  
CAMBRIDGE TECHNOLOGY

 **Novanta**  
PHOTONICS

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# 1 IMPORTANT INFORMATION



## IMPORTANT

For your protection, carefully read these instructions before installing and operating the scan head.

Retain these instructions for future reference.

Cambridge Technology reserves the right to update this user manual at any time without prior notification.

If product ownership changes, this manual should accompany the product.

## 1.1 SAFETY SYMBOLS



### DANGER

Indicates a hazardous situation which, if not avoided, will result in serious injury or death.

Its use should be limited to the most extreme situations.



### WARNING

Indicates a hazardous situation which, if not avoided, could result in serious injury or death.

 **CAUTION**

Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

 **IMPORTANT**

Indicates information considered important but not directly hazard related (e.g. security, hygiene, or equipment or property damage).

## 1.2 SAFETY LABELS

 **DANGER**

Laser radiation

can cause severe retinal and corneal burns, burns on the skin, and may pose a fire risk.

- To avoid injury and reduce risk of fire, please follow the control measures and safety guidelines provided by the laser's manufacturer, and those established by your Laser Safety Officer (LSO), Radiation Safety Officer (RSO), or safety department of your business or institution.

 **ESD WARNING**

Electrostatic discharge and improper handling  
can damage MOVIA scan head's electronics.

- Keep the equipment sealed until it is located at a proper static control station.

A proper static control station should include:

- A soft grounded conductive tabletop or grounded conductive mat on the tabletop.

- A grounded wrist strap with the appropriate (1 M $\Omega$ ) series resistor connected to the tabletop mat and ground.
- An adequate earth ground connection, such as a water pipe or AC ground.
- Conductive bags, trays, totes, racks, or other storage.
- Properly grounded power tools.
- Personnel handling ESD items should wear ESD protective garments and ground straps.



### IMPORTANT

Electrostatic discharge and improper handling can damage MOVIA scan head's electronics.

- Ship equipment returned to the factory in anti-static packaging.



### IMPORTANT

Customers assume all responsibility for maintaining a laser-safe working environment.

Original equipment manufacturer (OEM) customers assume all responsibility for CDRH (Center for Devices and Radiological Health) certification.

## 1.3 CUSTOMER SUPPORT

Before contacting Novanta Photonics for assistance, review appropriate sections in the manual that may answer your questions.

After consulting this manual, please contact one of our worldwide offices between 9 AM and 5 PM local time.

### Americas, Asia Pacific

Novanta Headquarters, Bedford, USA

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## 2 PRODUCT OVERVIEW

MOVIA scan heads are used as part of a galvanometer-based laser system and steer optical beams on a XY image field (2D) for all possible laser applications. See [Figure 1](#)

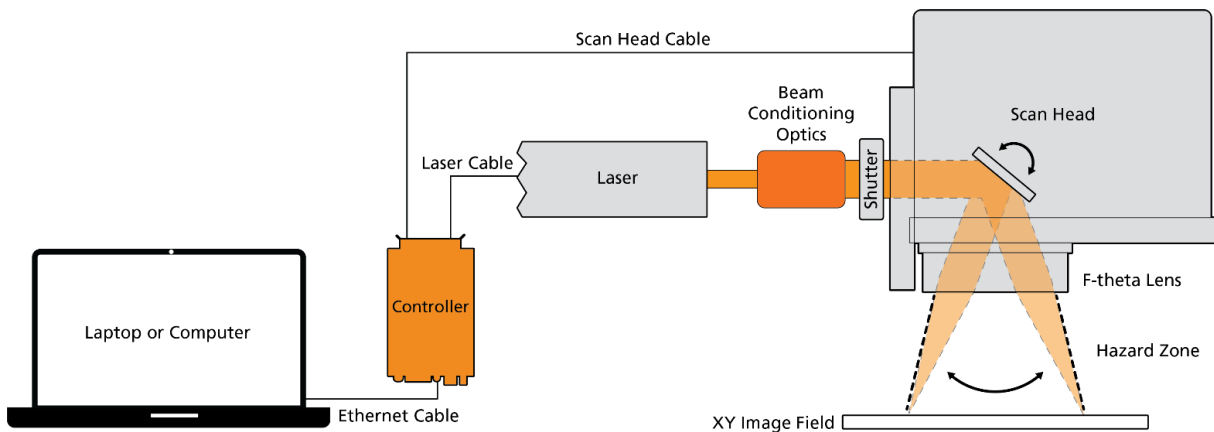


Figure 1: System Diagram

### 2.1 PRINCIPLES OF OPERATION

In a MOVIA scan head, two galvanometers scanners with mirrors synchronize and rotate to steer the laser beam across the XY field.

The beam enters the scan head through the input aperture and encounters the X mirror. The mirror-galvo pair is responsible for deflecting the beam, as directed, along the X axis of the scanning field. The laser beam then encounters the Y mirror, which deflects the beam along the Y axis.

With the use of a controller like Cambridge Technology's [ScanMaster Controller](#), you can accurately steer the laser beam anywhere within the usable field. See [Figure 2](#).



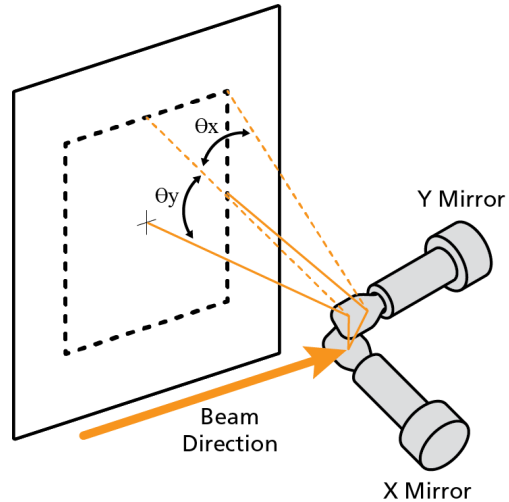


Figure 2: Beam Direction

## 2.2 PRODUCT USE

The MOVIA scan head is delivered as an OEM component for integration into a laser scanning system.

Customers must know and apply the rules and regulations for safe operation of lasers when installing and operating the scan head and the system in which it is used. Since Cambridge Technology has no influence over the employed laser or the overall system, the customer is solely responsible for the laser safety of the entire system.

The system manufacturer bears responsibility for complying with the standards and guidelines required for the CE (European Conformity) label. Please contact Cambridge Technology for further information about this product and applicable guidelines.

## 2.3 PRODUCT CONFIGURATION

To identify the configuration of your product, refer to the product label located on the side of the scan head. Information on the product label ([Figure 3](#)) identifies the model name, laser wavelengths compatible with the scan head ( $\lambda$ ), part number (PN), and serial number (SN) of your product.

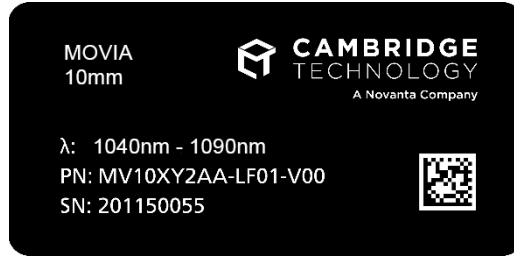


Figure 3: Product Label

# 3 INSTALLATION

## 3.1 REQUIRED SYSTEM PARTS

You will need the following components to set up the MOVIA scan head with the galvanometer-based laser system:

- Mounting Plate
- Mounting Hardware (4× M5 screws, 2× 4 mm dowel pins)
- Beam Conditioning Optic, such as a Beam Expander or Collimator (optional)
- F-Theta Lens
- F-Theta Lens Spacer
- System Controller <sup>1</sup>
- PC or Laptop
- Power Supply ( $\pm 15$  V)
- Power/Data Cable <sup>1</sup>
- MOVIA Scan Head
- Laser

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<sup>1</sup> Contact us for controller system (ScanMaster Controller) and Power/Data cable

## 3.2 RECOMMENDED ACCESSORIES (CUSTOMER SUPPLIED)

### LASER SHUTTER

The MOVIA scan head does not contain a shutter or device to decrease the laser output power. As each laser is unique, it is your responsibility to install a shutter or attenuator as required; please refer to US FDA Code of Federal Regulations (CFR) 1040.10 for additional information.

The beam shutter should be installed between the laser and the MOVIA scan head. [Figure 4](#) shows the laser's internal and external optical path, the location of the hazard zones as the optical beam passes through the scan head, and the recommended location of the shutter.

Cambridge Technology strongly recommends that customers obtain lasers with a vendor-supplied shutter mechanism. If not possible, consult your laser vendor to design or acquire a proper safety shutter.

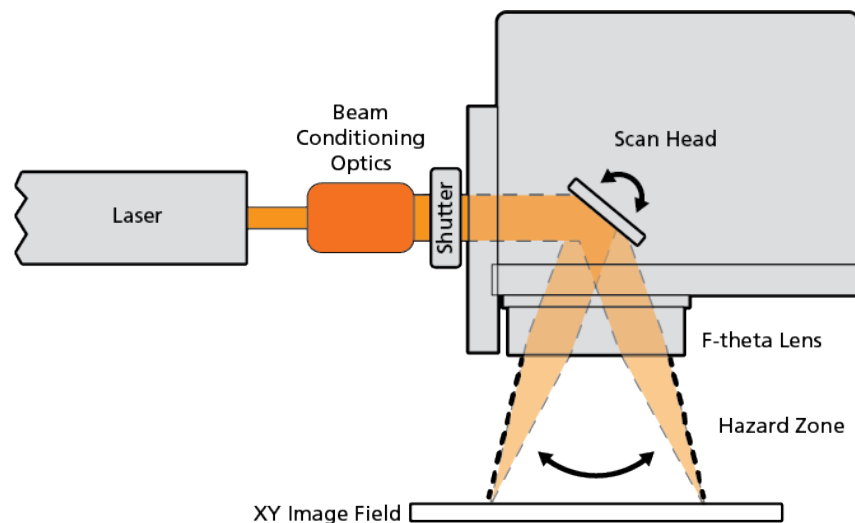


Figure 4: Location of Optical Beam Hazard Zones and Recommended Shutter Location

## 3.3 INSTALLATION INSTRUCTIONS

### 3.3.1 UNPACK THE MOVIA SCAN HEAD



#### ESD WARNING

Electrostatic discharge and improper handling can damage MOVIA scan head's electronics.

- Keep the equipment sealed until it is located at a proper static control station.

After receiving this product:

- Carefully unpack the contents from the box (verify content with packing list included with unit).
- Protect the scan head from dust and other contaminants.
- Save the shipping container and packaging material in case you need to return the unit for service.

### 3.3.2 MOUNT THE SCAN HEAD

Attach the scan head to the mounting plate using the mounting hardware.

The scan head has 2 metric dowel pin holes and 4 tapped mounting holes. See [Figure 5](#).

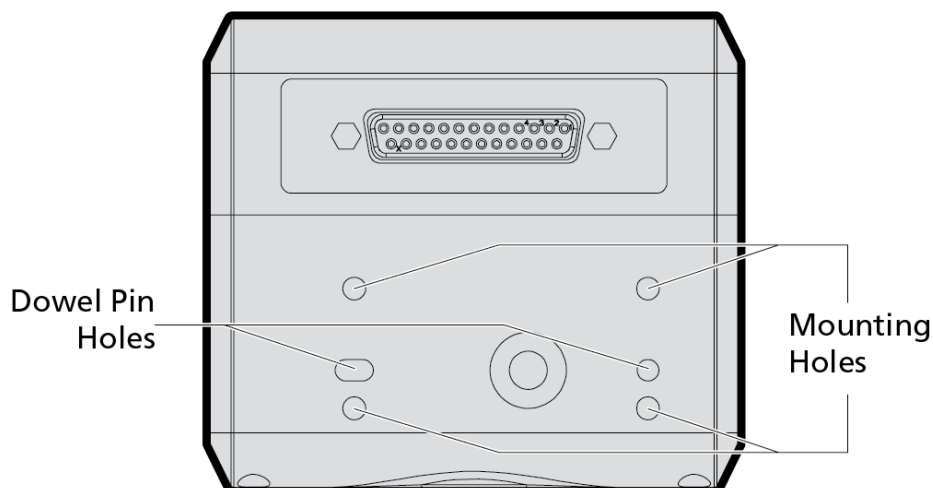


Figure 5: Location of Metric Dowel Pin Holes

### 3.3.3 ATTACH THE POWER/DATA CABLE TO THE SCAN HEAD

With power off, use the power/data cable to connect the MOVIA scan head to the system controller and  $\pm 15$  V power supply. It is recommended that the power supply voltages are verified before connecting the cable to the head to avoid any damage.

The usage of cable channels and pin assignments are described in [Table 1](#) and [Table 2](#).

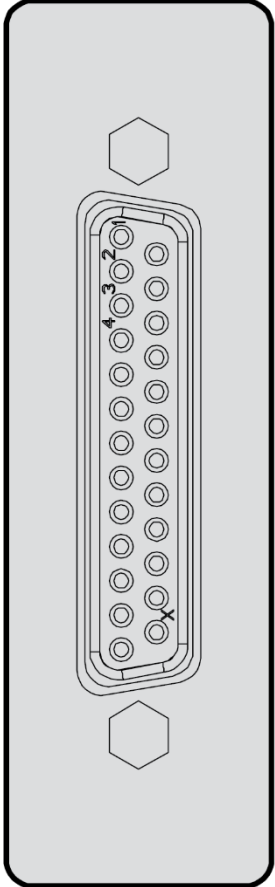
Table 1: Cable Channel Usage

Channels	Behavior
CLOCK	The Clock is transmitted by the position data generator, 20 cycles per frame. The nominal frequency is 2 MHz.
SYNC	The frame Sync is a single logical "0" pulse that occurs once per frame. It is transmitted by the position data generator one clock cycle prior to the first bit of the frame.
STATUS	The status channel provides error messages when scanner or servo exceptions occur.

Channels	Behavior
X Y Z DATA	<p>The vector controller used to drive the scan head will deliver set values for X, Y and the optional Z axis.</p> <p>The X, Y, and Z Data are three 20-bit serial data streams that consist of one 3-bit control code, one 16-bit position word (unsigned, MSB first), and an even parity bit.</p> <p>Improper control codes, parity error, or a missing sync on the 21<sup>st</sup> clock cycle will cause the position data word for the affected channel to be discarded. 001 is the only supported control code.</p>
GROUND AND VOLTAGE	The ground and voltage channels provide power to the scan head.

Table 2: Pin Assignments

Interface	Pin	Connection	Usage
	1	-SENDCLK	CLOCK
	2	-SYNC	SYNC
	3	-X	DATA
	4	-Y	DATA
	5	-Z	DATA
	6	-STATUS	STATUS
	7	N/C	RESERVED
	8	N/C	RESERVED
	9	+V	VOLTAGE
	10	+V	VOLTAGE
	11	GND	GROUND
	12	-V	VOLTAGE
	13	-V	VOLTAGE
	14	+SENDCK	CLOCK

Interface		Pin	Connection	Usage
	Pin 1	15	+SYNC	SYNC
	Pin 14	16	+X	DATA
		17	+Y	DATA
		18	+Z	DATA
		19	+STATUS	STATUS
		20	N/C	RESERVED
		21	N/C	RESERVED
		22	+V	VOLTAGE
		23	GND	GROUND
		24	GND	GROUND
		25	-V	VOLTAGE
Pin 13	Pin 25			



### 3.3.4 ELECTRICAL - POWER SUPPLY REQUIREMENTS

The maximum root mean square (rms) current required is approximately 3 amps, however peak current demands may approach 10 amps on certain models.

MOVIA scan heads are tuned for  $\pm 15$  V.



#### IMPORTANT

Higher voltage than specified  
may damage the servo.

- Use the correct voltage for the scan head.

### 3.3.5 APPLY POWER TO THE SCAN HEAD

Before powering on the overall system, confirm that you have the system controller (or ScanMaster Controller) configured correctly to work with your laser. For the ScanMaster Controller (SMC) refer to the [SMC Quick Start Guide](#). Once you've configured the controller to work with your laser and verified the function, you can power the scan head on.

Perform Alignment of the Laser to the Scan Head To reduce the risk of injury, please observe the laser safety guidelines in this section.



#### DANGER

Laser radiation  
can cause severe retinal and corneal burns, burns on the skin, and may pose a fire risk.

- Never stare into the laser's beam, place any parts of your body in the beam path, or expose yourself to reflections of beams.

**WARNING**

Laser radiation

can cause severe retinal and corneal burns, burns on the skin, and may pose a fire risk.

- Cambridge Technology recommends that you fully enclose and interlock the zone of hazard to prevent possible beam deflections while the laser is energized. See [Figure 4](#) for reference.

**CAUTION**

Laser radiation

can cause severe retinal and corneal burns, burns on the skin, and may pose a fire risk.

- Cambridge Technology recommends that you use a Class 1 HeNe Laser for alignment.  
If this is not possible, use the available laser's lowest power setting.

**CAUTION**

Laser radiation

can cause severe retinal and corneal burns, burns on the skin, and may pose a fire risk.

Using optical instruments with this product increases eye hazard.

- Use optical instruments with caution.

Additional safety requirements may be applicable during initial alignment of the optical system. Final recommendations and analysis of the system should be performed by your Laser Safety Officer (LSO), Radiation Safety Officer (RSO), or safety department of your business or institution.

Follow the laser manufacturer's instructions to perform the rough alignment of the laser to the scan head.

### 3.3.6 INSTALL THE F-THETA LENS AND REQUIRED LENS SPACER

Positioning of the F-Theta lens relative to the scan head is critical for both scanning performance and safety of the scanning mirrors.

Contact Cambridge Technology for F-Theta lens and lens spacer recommendations that will eliminate damaging major or minor back reflections from the optics onto the surface of the mirrors.

While Cambridge Technology can create custom spacers for non-standard lenses, you may also create a lens spacer. Contact Cambridge Technology for this product's model-specific drawing or the 3D Customer CAD model drawing to create a lens spacer.

When installing the F-Theta lens and spacer, ensure that your laser is powered down. Thread the spacer fully into the scan head, and then thread the F-Theta lens fully into the spacer. Failing to do so can lead to back reflections that could damage the mirrors in the scan head.

### 3.3.7 PERFORM SCAN HEAD CALIBRATION



#### DANGER

Laser radiation

can cause severe retinal and corneal burns, burns on the skin, and may pose a fire risk.

- Never stare into the laser's beam, place any parts of your body in the beam path, or expose yourself to reflections of beams.

 **WARNING**

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- Cambridge Technology recommends that you use a Class 1 HeNe Laser for alignment.

If this is not possible, use the available laser's lowest power setting.

 **CAUTION**

Laser radiation

can cause severe retinal and corneal burns, burns on the skin, and may pose a fire risk.

Using optical instruments with this product increases eye hazard.

- Use optical instruments with caution.

Each controller manufacturer has a specific process for creating a calibration table to remove any distortions caused by the lens and position of the scan head relative to the work area. The controller uses information in the correction table to pre-process the command data to remove these distortions.

Contact Cambridge Technology for correction tables that provide common scan head and lens configurations and are compatible with many commercial

controllers. We can also create correction tables for custom configurations on request.

In the case of the ScanMaster Controller, you would use Cambridge Technology's CalWizard software and follow the procedure outlined in the CalWizard manual and the Calibration Applications note.

After calibration has been completed, installation of the scan head is complete.

### 3.4 SET UP FOR INITIAL USE

Delay parameter settings are variable because each application's requirements and the controllers that are used fluctuate. Use the delay settings outlined in [Table 3](#) as a starting point, then fine tune the settings as needed.

For additional information on delay settings, see Cambridge Technology's CalWizard manual P0900-0157, Appendix A.

Table 3: Recommended Delay Settings for Initial Use

MOVIA 10mm Scan Head	
Mark Delay	130 $\mu$ s
Jump Delay	260 $\mu$ s
Poly Delay	65 $\mu$ s
Laser On	Laser-dependent
Laser Off	Laser-dependent

# 4 TROUBLESHOOTING AND MAINTENANCE

## 4.1 TROUBLESHOOTING

Table 4 outlines common issues that users experience while using a scan head. Complete the recommended actions to fix the issues.

If you need additional assistance, contact your local Cambridge Technology support representative; contact information is listed the Customer Support section on page 3.

Table 4: Scan Head Symptoms, Causes, and Recommended Actions

Symptom	Possible Cause	Recommended Action
Head does not create any marks.	Lens is out of focus.	Verify that lens is set to 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.	<ul style="list-style-type: none"><li>• Verify that all cables and wires are connected.</li><li>• Check continuity and verify pinout of power/data cable.</li></ul>

Symptom	Possible Cause	Recommended Action
Head only marks a spot in a random location of the field.	No power is going to the head.	<ul style="list-style-type: none"> <li>• Verify that all cables and wires are connected.</li> <li>• Check voltage of cable providing power to the scan head.</li> <li>• Check continuity and verify pinout of power/data cable.</li> </ul>
Low laser power.	Optics are dirty or damaged.	Inspect all optical surfaces for dirt or damage.
	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 coating.	Verify transmission of optics with a laser power meter.



## IMPORTANT

Operating temperature out of specification reduces MOVIA's optimum performance.

- Keep the scan head enclosure at 50 °C or below.

## 4.2 OPTIC CARE



### IMPORTANT

Improper handling

may damage scan head mirrors or lenses.

- Do not clean scan head mirrors or lenses unless you have the required training to safely clean the equipment.

Mirrors or lenses that are damaged while cleaning will not be covered under warranty.

It is recommended that you return the unit to Cambridge Technology for cleaning.



## 5 WARRANTY STATEMENT

The Customer shall examine each shipment within 10 days of receipt and inform Cambridge Technology of any shortage or damage. If no discrepancies are reported, Cambridge Technology shall assume the shipment was delivered complete and defect free.

Cambridge Technology warrants products against defects up to two years from manufacture date, barring unauthorized modifications or misuse. Repaired product is warranted 90 days after the repair is made, or two years after manufacture date - whichever is longer. Please contact Customer Service to obtain a Return Materials Authorization (RMA) number before returning any product for repair. All orders are subject to the Cambridge Technology Terms and Conditions and Limited Warranty.

Please visit our website [www.novantaphotonics.com](http://www.novantaphotonics.com) for the latest version of these documents and other useful information.



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