HXP200-MECA & HXP200S-MECA Hexapods

High Load 6-Axis-Parallel Kinematic Positioning Systems

Newport®

USER'S MANUAL

Warranty

Newport Corporation warrants this product to be free from defects in material and workmanship for a period of 1 year from the date of shipment. If found to be defective during the warranty period, the product will either be repaired or replaced at Newport's discretion.

To exercise this warranty, write or call your local Newport representative, or contact Newport headquarters in Irvine, California. You will be given prompt assistance and return instructions. Send the instrument, transportation prepaid, to the indicated service facility. Repairs will be made and the instrument returned, transportation prepaid. Repaired products are warranted for the balance of the original warranty period, or at least 90 days.

Limitation of Warranty

This warranty does not apply to defects resulting from modification or misuse of any product or part.

CAUTION

Warranty does not apply to damages resulting from:

- **Incorrect usage:**
  - **Load on the Hexapod greater than maximum specified load.**
  - **Carriage speed higher than specified speed.**
  - **Improper grounding.**
    - ¬ **Connectors must be properly secured.**
    - ¬ **When the load on the Hexapod represents an electrical risk, it must be connected to ground.**
  - **Excessive or improper cantilever loads.**
- **Modification of the Hexapod or any part thereof.**

CAUTION

Please return equipment in the original (or equivalent) packing.

You will be responsible for damage incurred from inadequate packaging if the original packaging is not used.

This warranty is in lieu of all other warranties, expressed or implied, including any implied warranty of merchantability or fitness for a particular use. Newport Corporation shall not be liable for any indirect, special, or consequential damages.

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EC Declaration of Conformity

HXP200-MECA

Newport®

EU Declaration of Conformity

following Annex II-1A
of Directive 2006/42/EC on machinery

The manufacturer:

MICRO-CONTROLE Spectra-Physics,
9 rue du Bois Sauvage
F-91055 Evry FRANCE

Hereby declares that the machinery:

- Description: " HXP200-MECA "
- Function: 6-Axis Kinematic Positioning System
- Models: HXP200-MECA ; HXP200S-MECA ;HXP200HA-MECA ; HXP200SHA-MECA

– the technical file of which was compiled by:

Mr Hervé LE COINTE, Quality Director,
MICRO-CONTROLE Spectra-Physics, Zone Industrielle - B.P.29
F-45340 Beaune La Rolande France

– complies with all the relevant provisions of the Directive 2006/42/EC on machinery.
– complies with all the relevant provisions of the Directive 2014/30/EU relating to electro-magnetic compatibility.
– complies with all the relevant provisions of the Directive 2011/65/EU relating to RoHS2.

– was designed and built in accordance with the following harmonised standards:

- NF EN 61326-1:2013 « Electrical equipment for measurement, control and laboratory use – EMC requirements – Part 1: General requirements »
- NF EN 55011:2010/A1:2011 Class A

– was designed and built in accordance with the following other standards:

- NF EN 61000-4-2
- NF EN 61000-4-3
- NF EN 61000-4-4
- NF EN 61000-4-5
- NF EN 61000-4-6

ORIGINAL DECLARATION

Done in Beaune La Rolande on 16 May 2017
Hervé LE COINTE
Quality Director

DC1-EN rev:A

Definitions and Symbols

The following terms and symbols are used in this documentation and also appear on the product where safety-related issues occur.

General Warning or Caution

The exclamation symbol may appear in warning and caution tables in this document. This symbol designates an area where personal injury or damage to the equipment is possible.

The following are definitions of the Warnings, Cautions and Notes that may be used in this manual to call attention to important information regarding personal safety, safety and preservation of the equipment, or important tips.

WARNING

Warning indicates a potentially dangerous situation which can result in bodily harm or death.

CAUTION

Caution indicates a potentially hazardous situation which can result in damage to product or equipment.

NOTE

Note indicates additional information that must be considered by the user or operator.

European Union CE Mark

The presence of the CE Mark on Newport Corporation equipment means that it has been designed, tested and certified as complying with all applicable European Union (CE) regulations and recommendations.

Warnings and Cautions

ATTENTION

This stage is a Class A device. In a residential environment, this device can cause electromagnetic interference. In this case, suitable measures must be taken by the user.

Warnings

WARNING

The motion of objects of all types carries potential risks for operators. Ensure the protection of operators by prohibiting access to the dangerous area and by informing the personnel of the potential risks involved.

WARNING

Do not use this Hexapod when struts are emitting smoke or is unusually hot to the touch or are emitting any unusual odor or noise or is in any other abnormal state.

Stop using the Hexapod immediately, switch off struts power and then disconnect the HXP controller from power supply.

After checking that smoke is no longer being emitted contact your Newport service facility and request repairs. Never attempt to repair the Hexapod yourself as this can be dangerous.

WARNING

Make sure that this Hexapod is not exposed to moisture and that liquid does not get into the Hexapod.

Nevertheless, if any liquid has entered the Hexapod, switch off struts power and then disconnect the HXP controller from power supply.

Contact your Newport service facility and request repairs.

WARNING

Do not insert or drop objects into this Hexapod, this may cause an electric shock, or lock the drive.

Do not use this Hexapod if any foreign objects have entered the Hexapod. Switch off struts power and then disconnect the HXP controller from power supply.

Contact your Newport service facility for repairs.

WARNING

Do not place this Hexapod in unstable locations such as on a wobbly table or sloping surface, where it may fall or tip over and cause injury.

If this Hexapod has been dropped or the case has been damaged, switch off struts power and then disconnect the HXP controller from power supply.

Contact your Newport service facility and request repairs.

WARNING

Do not attempt to modify this Hexapod; this may cause an electric shock or downgrade its performance.

WARNING

Do not exceed the usable depth indicated on the mounting holes (see section “Dimensions”). Longer screws can damage the mechanics or cause a short-circuit.

WARNING

The hexapods can be used in any position. They must imperatively be properly fixed, as their boarded load, with enough points according to the configuration and the mass.

Caution

CAUTION

Do not place this Hexapod in a hostile environment such as X-Rays, hard UV,… or in any vacuum environment.

CAUTION

Do not manipulate struts. This may cause it to malfunction.

CAUTION

Do not place this Hexapod in a location affected by dust, oil fumes, steam or high humidity. This may cause an electric shock.

CAUTION

Do not leave this Hexapod in places subject to extremely high temperatures or low temperatures. This may cause an electric shock.

- **Operating temperature: +10 to +35 °C**
- **Storage temperature: -10 to +40 °C (in its original packaging)**

CAUTION

Do not move this Hexapod if struts power is on.

Make sure that the cable to the electronics is disconnected before moving the Hexapod. Failure to do so may damage the cable and cause an electrical shock.

CAUTION

Be careful that the Hexapod is not bumped when it is being carried. This may cause it to malfunction.

CAUTION

When handling this Hexapod, always unplug the equipment from the power source for safety.

CAUTION

Contact your Newport service facility to request cleaning and specification control every year.

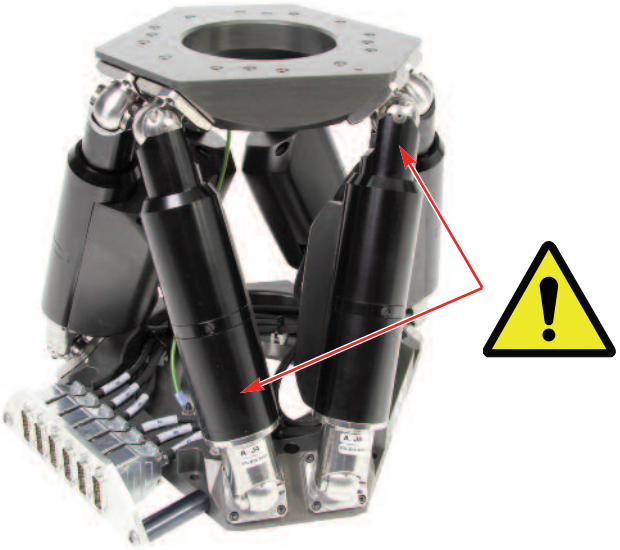
CAUTION

When enabling and disabling motors, the hexapod position may drift slightly (~0.1 mm) due to the load during brake transition.

High Load 6-Axis-Parallel Kinematic Positioning Systems HXP200-MECA & HXP200S-MECA Hexapods

1.0 Introduction

This manual provides operating instructions for the HXP200-MECA or HXP200S-MECA Hexapod that you have purchased.



ATTENTION

Do not manually turn struts.

CAUTION

Please read all chapters of this manual carefully before operating your Hexapod.

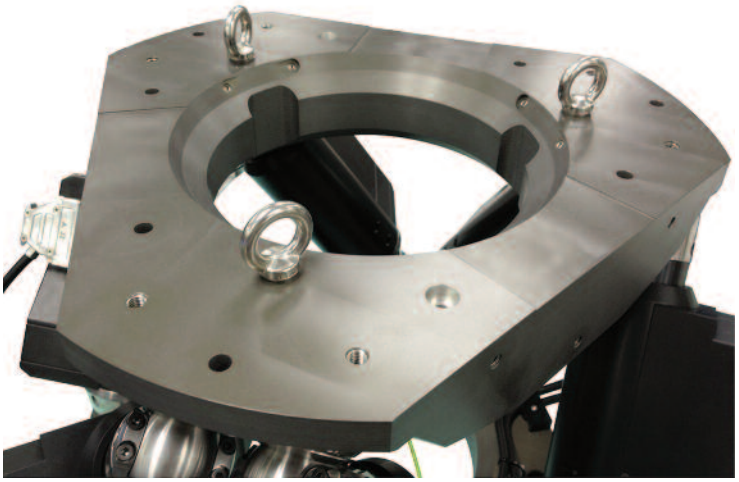
1.1 Unpacking

HXP200-MECA & HXP200S-MECA Hexapods.

CAUTION

Both hexapods can be handled by the top plate either manually or using 3 hoisting rings.

The HXP200-MECA and HXP200S-MECA weigh 34.2 lb (15.5 kg) and 54.9 lb (24.9 kg) respectively. Therefore, we recommend using proper lifting techniques and personnel protection to handle these Hexapods.



CAUTION

Do not handle the Hexapods by the struts, the cables or the connectors.

2.0 Description

The HXP200-MECA and HXP200S-MECA high load Hexapods are parallel kinematic motion devices that provide six degrees of freedom: X, Y, Z, pitch, roll, and yaw.

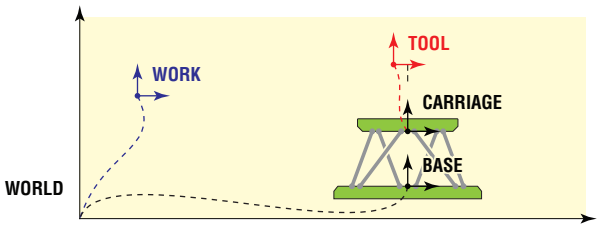
- The HXP200-MECA is an effective solution to complex motion applications that demand a high load capacity of up to 50 kg centered and offset loads of at least 5 kg.
- The HXP200S-MECA is a wider and stiffer version of the HXP200-MECA, capable of handling 85 kg centered and offset loads of at least 11 kg.

Both Hexapods also feature long travel ranges, fast speeds, high stiffness and stability. They are driven by six DC servo motor actuators which provide precise MIM. A brake on the actuator eliminates drift at power-off conditions. A critical design feature that enhances the overall motion performance is the joints with which the actuators are attached to the base and the moving top plate. The preloaded and backlash-free, cardan joints enhance not only the repeatability and positioning performance of both HXP200-MECA and HXP200S-MECA, but are also key to its position stability and stiffness.

As a standard feature, the HXP200-ELEC-D and HXP200S-ELEC-D controllers allow the user to choose a virtual pivot point in space for all rotations.

Coupled with the HXP200-ELEC-D or HXP200S-ELEC-D, a pair of flexible and programmable coordinate systems or pivot points are available. Other features include RightPath™, trajectory control for low run out and constant velocity trajectories along lines, arcs or rotations. Two additional single-axis stages can also be added, as well as remote joystick control. A free simulation software can be downloaded to determine the limits of position and load for specific applications. For easy programming and automation, the controller also includes instrument grade I/O's, hardware based input triggers, event triggers, high speed on-the-fly data acquisition, fast TCP/IP communication, and integrated TCL programming language for on-board processes.

A requirement for many Hexapod motion applications is a virtual pivot point, allowing the user to freely choose the pivot point in space for all rotations. Newport has taken this a step further by providing two pivot points. The two user-definable coordinate systems provided, called tool (moves with the Hexapod) and work (stationary coordinate system) are programmable and flexible. Imagine a machine tool where one can adjust the orientation of both the cutting tool and workpiece or in photonics, the optical beam and the sample. Incremental displacements are possible in either one in user-friendly Cartesian coordinates, and positions can be easily switched from one system to the other by a function call. These powerful functions are a completely new way of mastering Hexapod motions without the need for complex external coordinate transformations.



Absolute moves and positions are defined in the work coordinate system. Incremental moves can be done in the tool or in the work coordinate systems.

3.0 Characteristics

3.1 Mechanical Specifications

	HXP200-MECA					
	X	Y	Z	U (Rx)	V (Ry)	W (Rz)
Travel range [1]	±59 mm	±54 mm	±25 mm	±15°	±14.5°	±30°
MIM, Minimum incremental motion	0.2 µm	0.2 µm	0.1 µm	0.1 mdeg	0.1 mdeg	0.2 mdeg
Uni-directional repeatability, typical	±0.125 µm	±0.125 µm	±0.1 µm	±0.1 mdeg	±0.1 mdeg	±0.125 mdeg
Max. speed	81 mm/s	70 mm/s	26 mm/s	16 °/s	15 °/s	41 °/s
Stiffness	3 N/µm	3 N/µm	40 N/µm	–	–	–
Centered load capacity [4]	500 N					

	HXP200S-MECA					
	X	Y	Z	U (Rx)	V (Ry)	W (Rz)
Travel range [1]	±40 mm	±45 mm	±27 mm	±9°	±8°	±15°
MIM, Minimum incremental motion	0.15 µm	0.15 µm	0.15 µm	0.1 mdeg	0.1 mdeg	0.1 mdeg
Uni-directional repeatability, typical	±0.1 µm	±0.1 µm	±0.1 µm	±0.1 mdeg	±0.1 mdeg	±0.1 mdeg
Max. speed	47 mm/s	54 mm/s	29 mm/s	10 °/s	9.3 °/s	16.5 °/s
Stiffness	6 N/µm	6 N/µm	30 N/µm	–	–	–
Centered load capacity [4]	850 N					

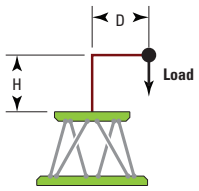
[1] Travel ranges are interdependent. The listed values are max. travels per axis when all other axis are in their centered position.
[2] Stiffness depends on hexapod position. Values are given for all axis in their centred position.
[3] For allowable cantilevered loads, refer to section 3.2: "Max. Cantilever Distance of the Load".

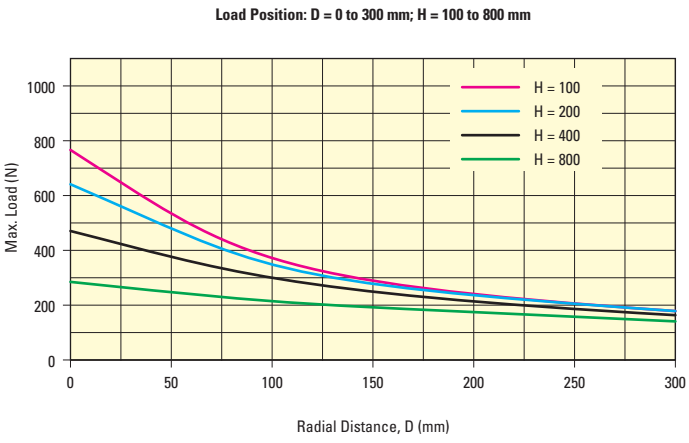
CAUTION

To reach specifications stated, stages must be fixed on a plane surface with a flatness of 20 µm or better.

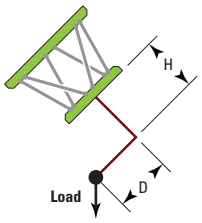
3.2 Max. Cantilever Distance of the Load

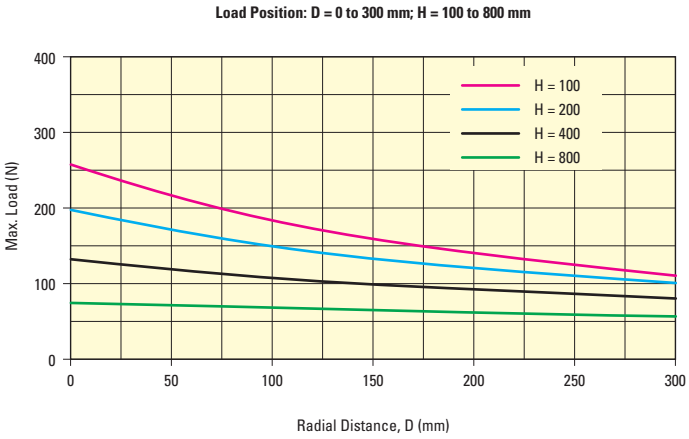
3.2.1 HXP200-MECA Horizontal Base Plate



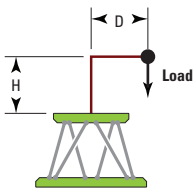


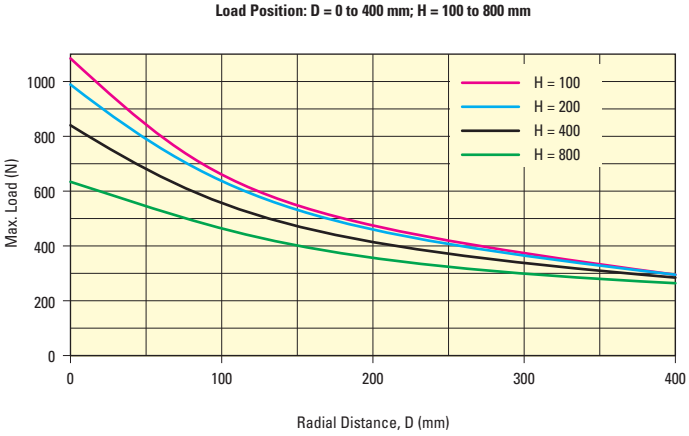
3.2.2 HXP200-MECA Base Plate at Any Position



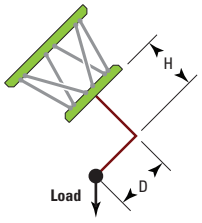


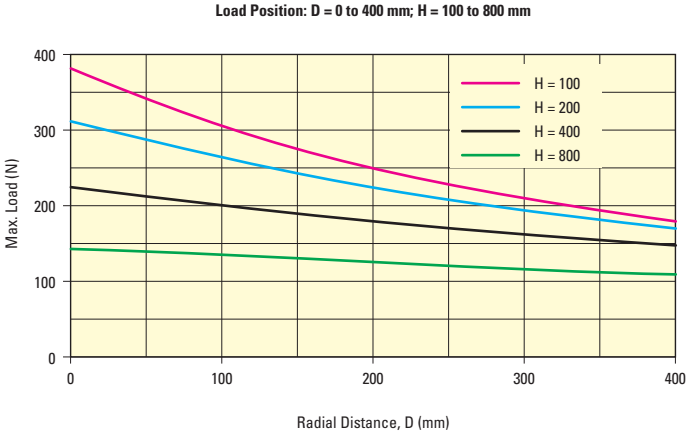
3.2.3 HXP200S-MECA Horizontal Base Plate





3.2.4 HXP200S-MECA Base Plate at Any Position





3.3 Weights

	Weight [lb (kg)]
HXP200-MECA (without cables)	34.2 (15.5)
HXP200S-MECA (without cables)	54.9 (24.9)
Cables, length 16.4 ft (5 m)	10.6 (4.8)

4.0 Connection to the HXP200-ELEC-D or HXP200S-ELEC-D Controller

4.1 Warnings on Controllers

Controllers are intended for use by qualified personnel who recognize shock hazards and are familiar with safety precautions required to avoid possible injury. Read the controller user's manual carefully before operating the instrument and pay attention to all written warnings and cautions.

WARNING

Disconnect the power plug under the following circumstances:

- **If the power cord or any attached cables are frayed or damaged in any way.**
- **If the power plug is damaged in any way.**
- **If the unit is exposed to rain, excessive moisture, or liquids are spilled on the unit.**
- **If the unit has been dropped or the case is damaged.**
- **If you suspect service or repair is required.**
- **Whenever you clean the electronics unit.**

CAUTION

To protect the unit from damage, be sure to:

- **Keep all air vents free of dirt and dust.**
- **Keep all liquids away from the unit.**
- **Do not expose the unit to excessive moisture (85% humidity).**
- **Read this manual before using the unit for the first time.**

WARNING

All attachment plug receptacles in the vicinity of this unit are to be of the grounding type and properly polarized.

Contact your electrician to check your receptacles.

WARNING

This product is equipped with a 3-wire grounding type plug.

Any interruption of the grounding connection can create an electric shock hazard.

If you are unable to insert the plug into your wall plug receptacle, contact your electrician to perform the necessary alterations to ensure that the green (green-yellow) wire is attached to earth ground.

WARNING

This product operates with voltages that can be lethal.

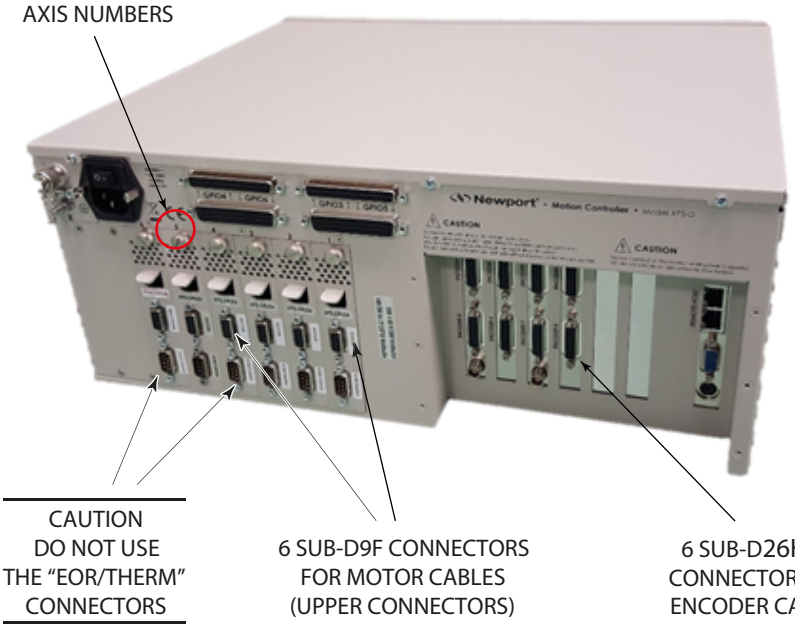
Pushing objects of any kind into cabinet slots or holes, or spilling any liquid on the product, may touch hazardous voltage points or short out parts.

4.2 Connection

WARNING

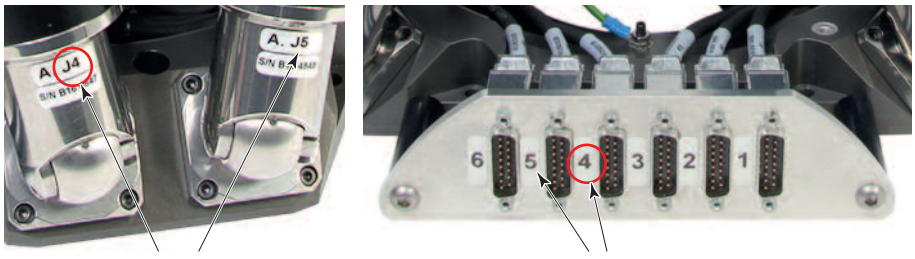
Always turn the controller's power OFF before connecting to a strut.

Anytime prior to power-up, each strut must be connected with the supplied cable to the corresponding SUB-D9F plug labeled "MOTOR" and SUB-D26HDF plug labeled “ENCODER” located at the rear panel of the HXP200-ELEC-D or HXP200S-ELEC-D controller.



WARNING

Each Hexapod strut label corresponds to the axis number on the HXP200-ELEC-D or HXP200S-ELEC-D controller. This label is also indicated on connectors of the strut.



4.3 Cables

Each Hexapod is equipped with 5-meter cables terminated with SUB-D connectors. These cables must connect the struts to the corresponding axis on the HXP200-ELEC-D or HXP200S-ELEC-D controller.

CAUTION

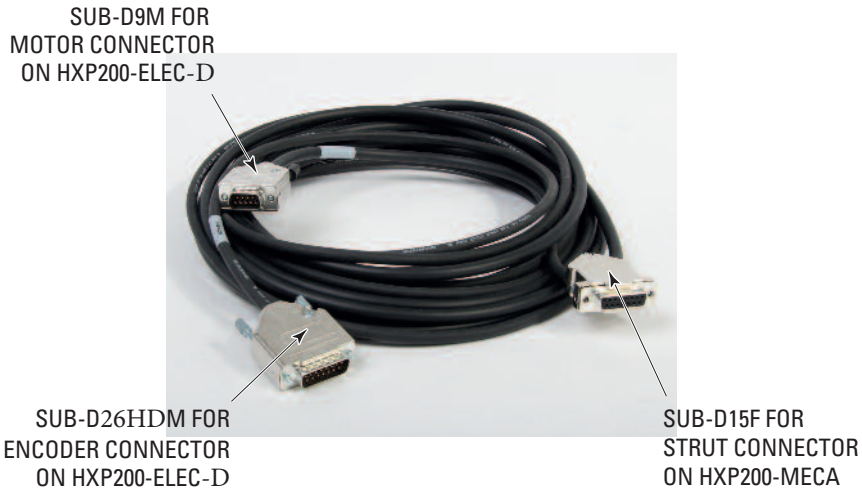
Numbering of axes is important for both motor and encoder connections. A mismatch will cause fatal errors during initialization or unexpected hexapod motions. These cables must connect the struts to the corresponding "MOTOR" and "ENCODER" sockets.

WARNING

These cables are shielded correctly. For a correct operation, make sure to lock connectors (ground continuity provided by the cable).

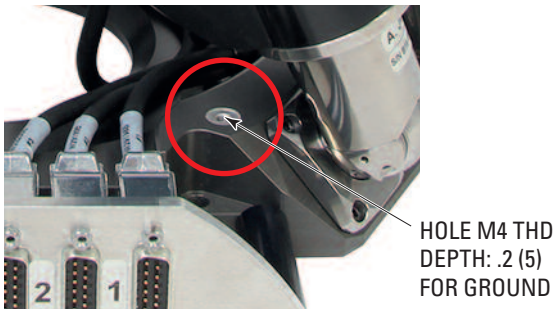
WARNING

Keep the motor cables at a safe distance from other electrical cables in your environment to avoid potential cross talk.



WARNING

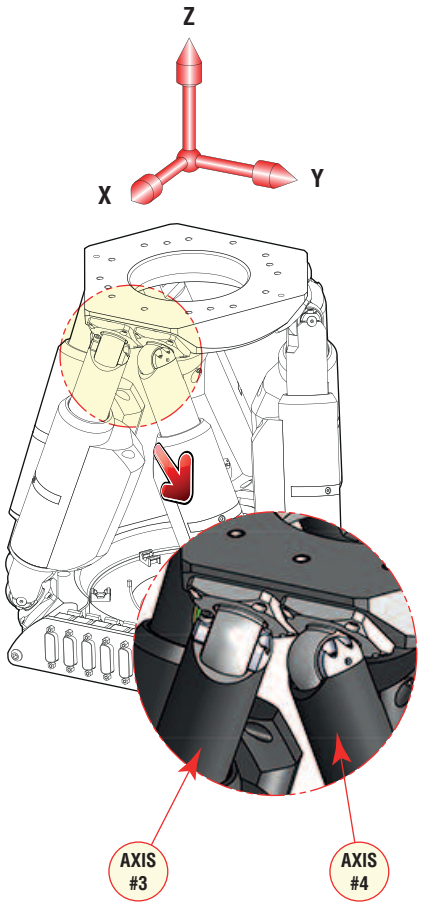
Both HXP200-MECA and HXP200S-MECA must be grounded via a M4 threaded hole to avoid electrical disturbances generated by ground loops (see image below).



5.0 Dimensions

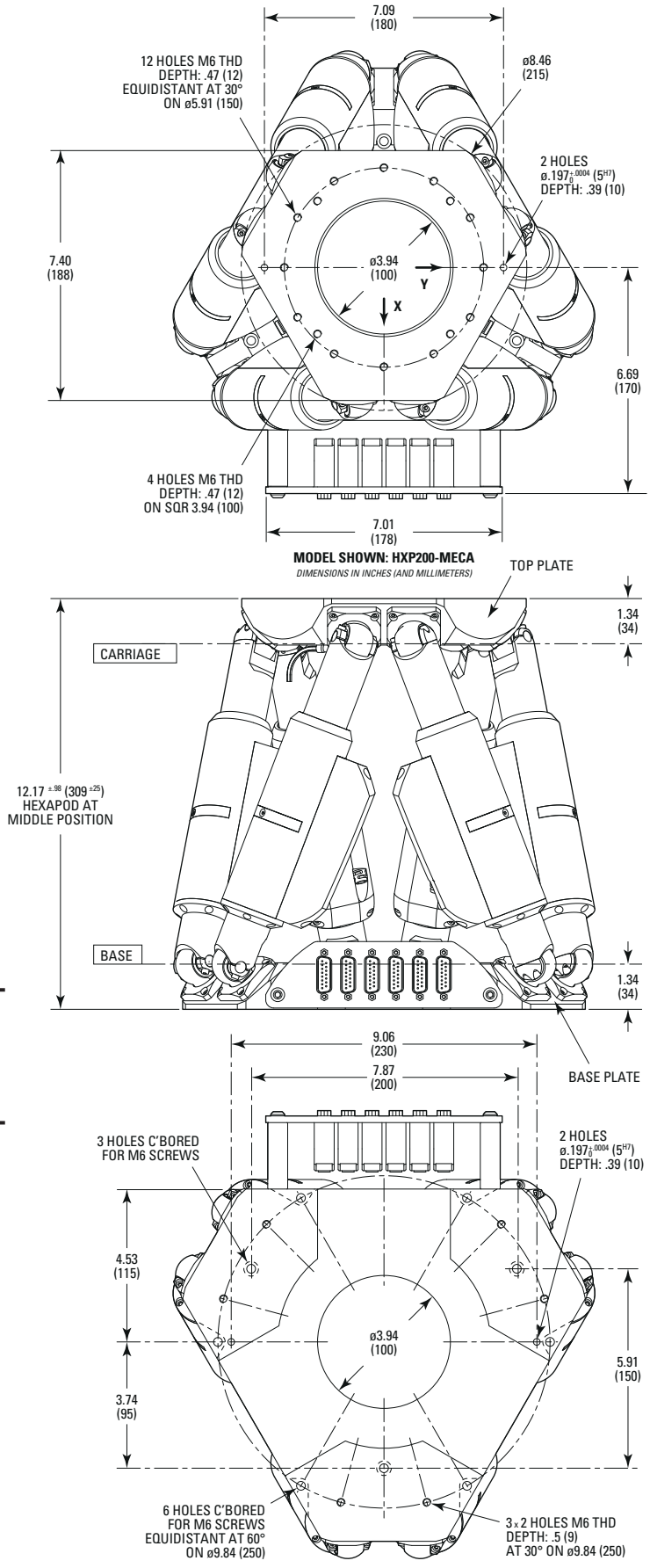
5.1 HXP200-MECA Hexapod

NOTE
The +X-axis points in the direction of the cable output between struts #3 and #4.



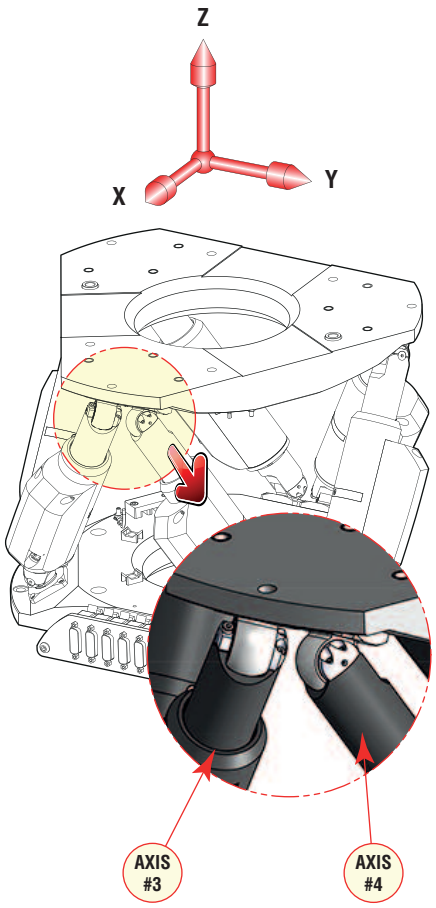
NOTE

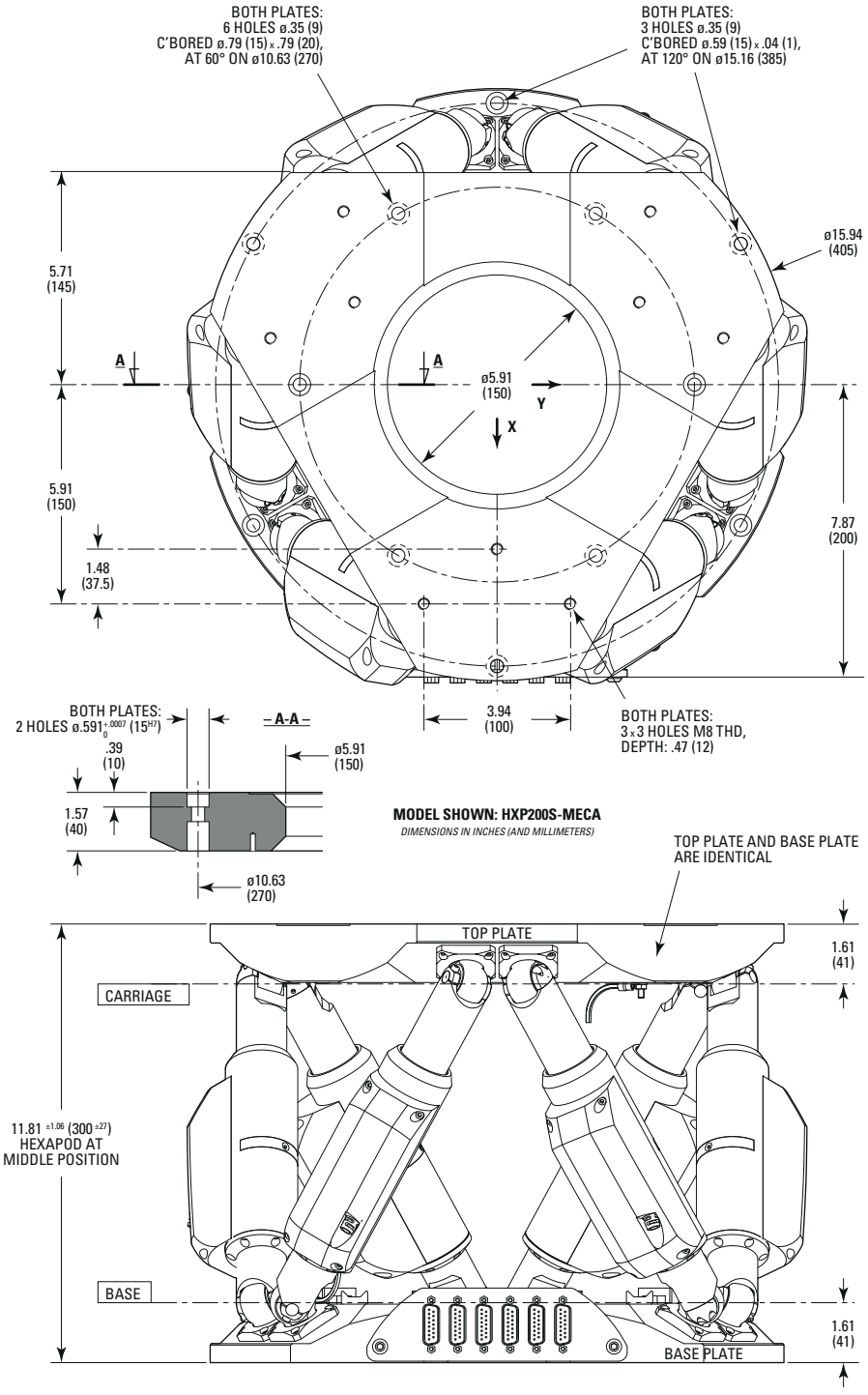
Top and base plates of the HXP200-MECA Hexapod are made of hard anodized aluminum.



5.2 HXP200S-MECA Hexapod

NOTE
The +X-axis points in the direction of the cable output between struts #3 and #4.





NOTE

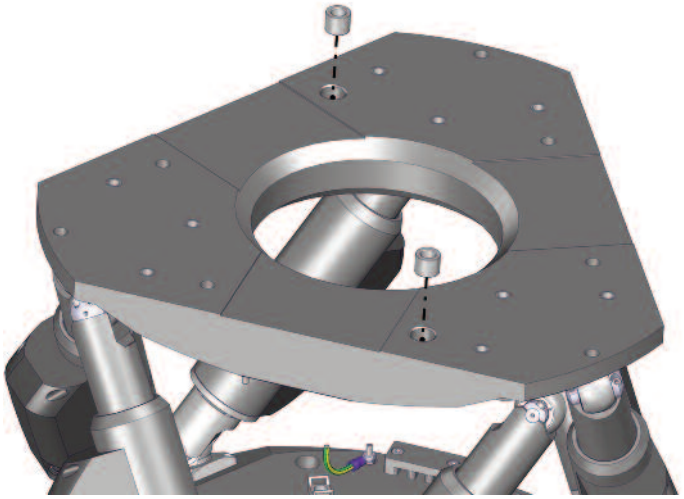
Top and base plates of the HXP200S-MECA Hexapod are made of hard anodized aluminum.

6.0 Accessory

6.1 Centering Dowels

The HXP200S-MECA is delivered with a set of 4 steel centering dowels. They can be housed in the 2 holes ø $0.591^{+.0007}_{0}$ (15^{H7}) located in the top plate and the base plate of the Hexapod. They allow precise positioning of the hexapod on its support or equipment on the moving top plate.

When in place, these dowels stand approximately 0.08 in. (2 mm) above the plate surface.



7.0 Maintenance

RECOMMENDATION

Please contact Technical Sales Support team for recommendations on application specific maintenance.

7.1 Maintenance

The Hexapod requires no particular maintenance. Nevertheless, this is a precision mechanical device that must be kept and operated with caution.

PRECAUTIONS

The Hexapod must be used or stocked in a clean environment, without dust, humidity, solvents or other substances.

RECOMMENDATION

It is recommended to return the Hexapod to Newport for re-lubrication after 2000 hours of use.

If the HXP200-MECA is mounted on a workstation and cannot be easily removed, please contact Newport's After Sales Service for further instructions.

7.2 Repair

CAUTION

Never attempt to disassemble a component of the Hexapod that has not been covered in this manual.

To disassemble a non specified component can cause a malfunction of the stage.

If you observe a malfunction in your Hexapod, please contact us immediately to arrange for a repair.

CAUTION

Any attempt to disassemble or repair a Hexapod without prior authorization will void your warranty.

Service Form

Your Local Representative
Tel.: _____
Fax: _____

Name: _____ Return authorization #: _____
(Please obtain prior to return of item)

Company: _____

Address: _____ Date: _____

Country: _____ Phone Number: _____

P.O. Number: _____ Fax Number: _____

Item(s) Being Returned:

Model #: _____ Serial #: _____

Description: _____

Reasons of return of goods (please list any specific problems): _____

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