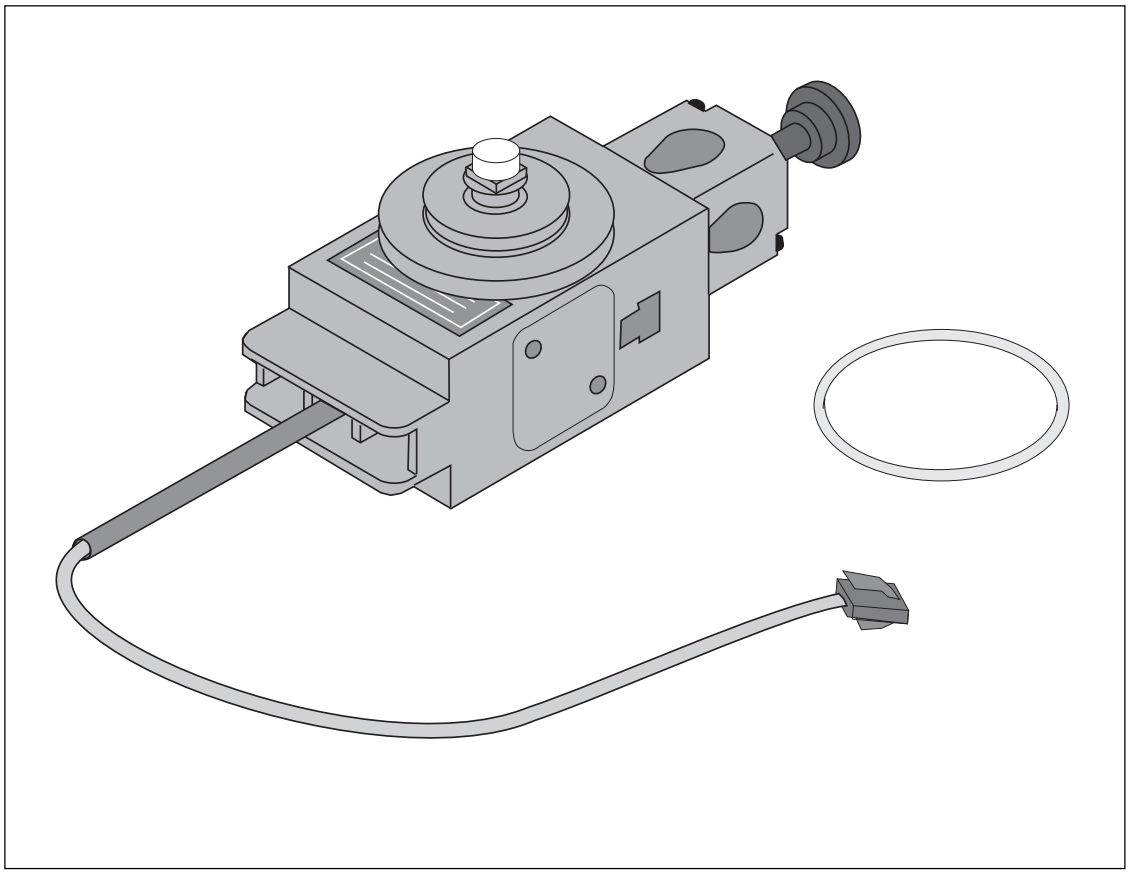
Instruction Manual and Experiment Guide for the PASCO scientific Model CI-6625

012-06099A
9/96

ROTARY MOTION SENSOR FOR ULI



$5.00

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Credits

This manual authored by: Jon Hanks

Equipment Return

Should the product have to be returned to PASCO scientific for any reason, notify PASCO scientific by letter, phone, or fax BEFORE returning the product. Upon notification, the return authorization and shipping instructions will be promptly issued.

➤ **NOTE:** NO EQUIPMENT WILL BE ACCEPTED FOR RETURN WITHOUT AN AUTHORIZATION FROM PASCO.

When returning equipment for repair, the units must be packed properly. Carriers will not accept responsibility for damage caused by improper packing. To be certain the unit will not be damaged in shipment, observe the following rules:

① The packing carton must be strong enough for the item shipped.

② Make certain there are at least two inches of packing material between any point on the apparatus and the inside walls of the carton.

③ Make certain that the packing material cannot shift in the box or become compressed, allowing the instrument come in contact with the packing carton.

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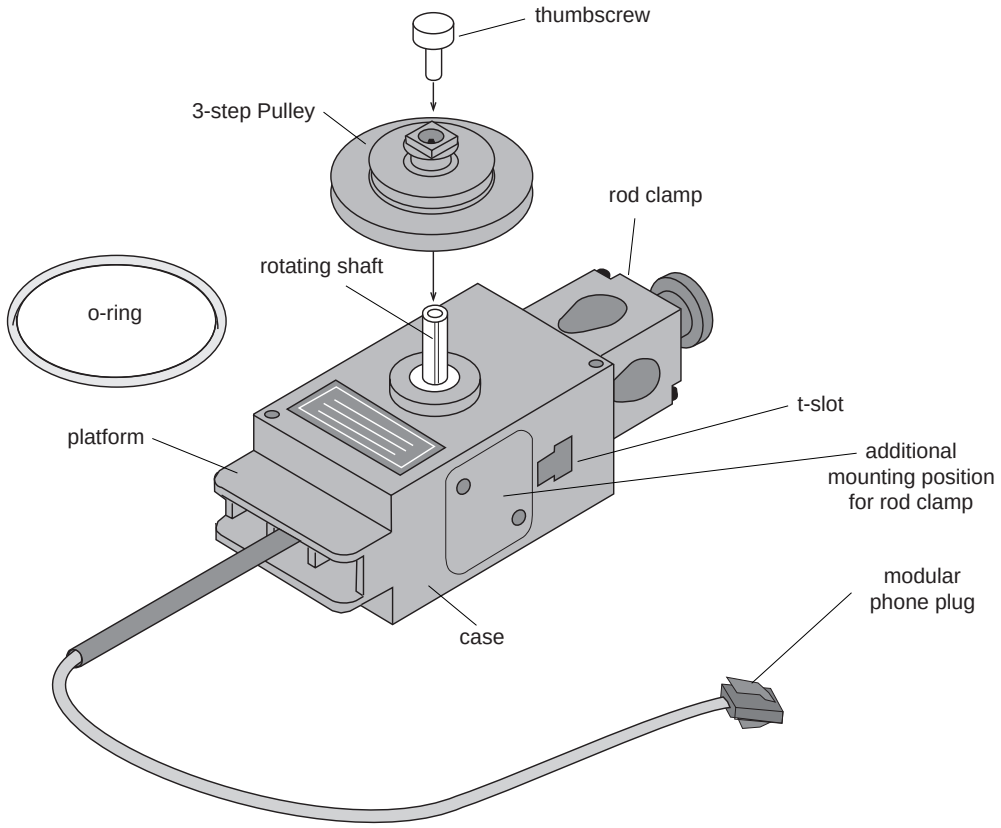
Introduction

The PASCO CI-6625 Rotary Motion Sensor for ULI (RMS) is a bidirectional position sensor designed for use with the Vernier ULI It contains an optical encoder which gives a maximum of 1440 counts per revolution (360 degrees) of the Rotary Motion Sensor shaft. The resolution can be set in the ULI software to 360 or 1440 times per revolution (1 degree or 1/4 degree).

The Rotary Motion Sensor has a modular phone plug which plugs into port 2 on the ULI interface box.

The rod clamp can be mounted on three sides of the sensor case, allowing the Rotary Motion Sensor to be mounted on a rod stand in many different orientations. The 3-step Pulley keys into the rotating shaft and can be mounted on either end of the shaft. A rubber o-ring is intended to be slipped over the largest pulley step so the RMS can be pressed against a surface to sense the relative motion between the sensor and the surface. The end of the Rotary Motion Sensor where the cord exits the case provides a platform for mounting a clamp-on Super Pulley. The t-slot in either side of the RMS is for inserting the optional Linear Motion Accessory rack. This allows you to measure linear motion over the length of the rack.

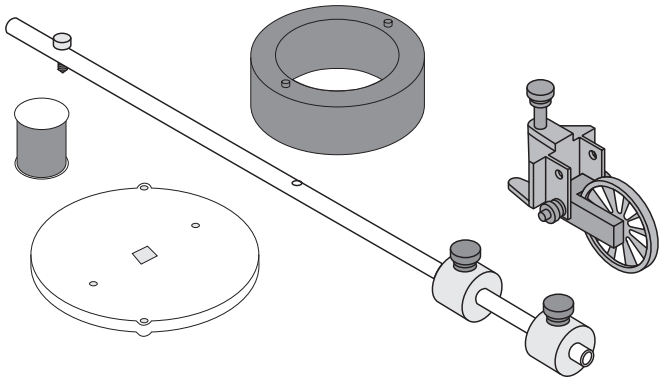


Rotary Motion Sensor Parts

Optional Accessories

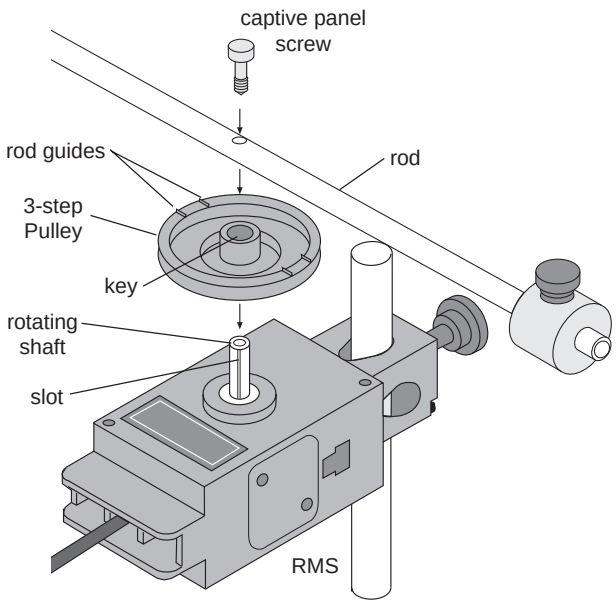
Mini-Rotational Accessory

The PASCO CI-6691 Mini-Rotational Accessory is used to perform rotational inertia experiments, conservation of angular momentum experiments, and pendulum experiments. Included are an aluminum disk, a steel ring, a long thin rod, and two brass masses which can be attached at any point on the thin rod to act as point masses.



Attaching the Rod

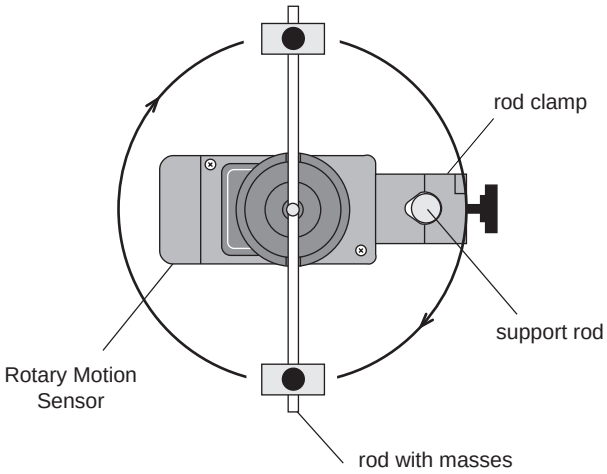
To attach the rod to the RMS, it is necessary to orient the 3-step Pulley so the rod guides on the underside of the pulley face up. The 3-step Pulley and the rotating shaft on the RMS are keyed to assemble only in one position. Assemble the apparatus as illustrated.



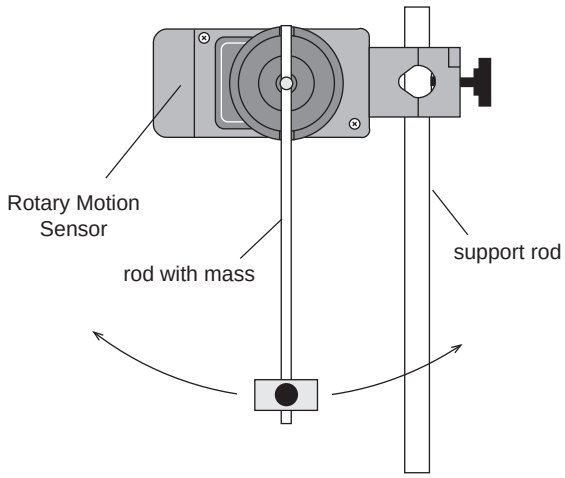
Using the Rod

The rod can be used for two purposes:

- The center of the rod can be attached to the RMS rotating shaft and used with the point masses to find the rotational inertia of point masses.



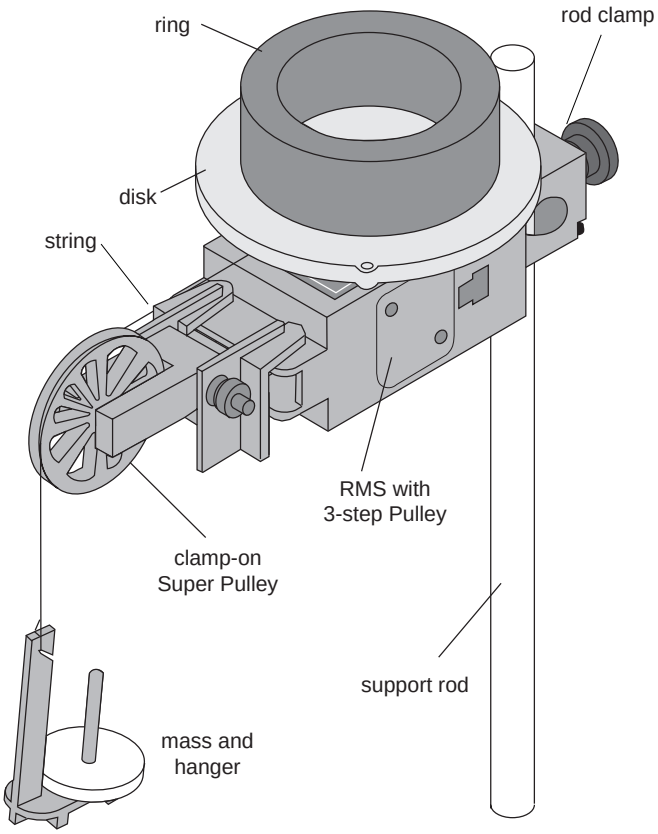
- The end of the rod can be attached to the Rotary Motion Sensor rotating shaft to use it as a pendulum.



Using the Disk and Ring

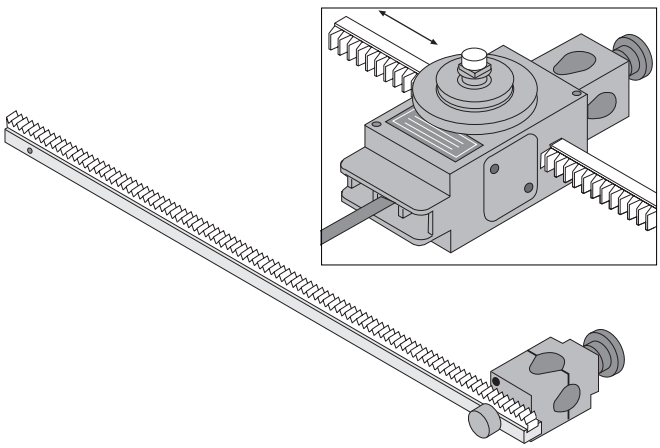
For rotational inertia experiments, wrap a string attached to a mass around the 3-step Pulley included with the Rotary Motion Sensor. Hang the mass over the clamp-on Super Pulley to accelerate the apparatus.

Perform a conservation of angular momentum experiment by dropping the ring onto the rotating disk.



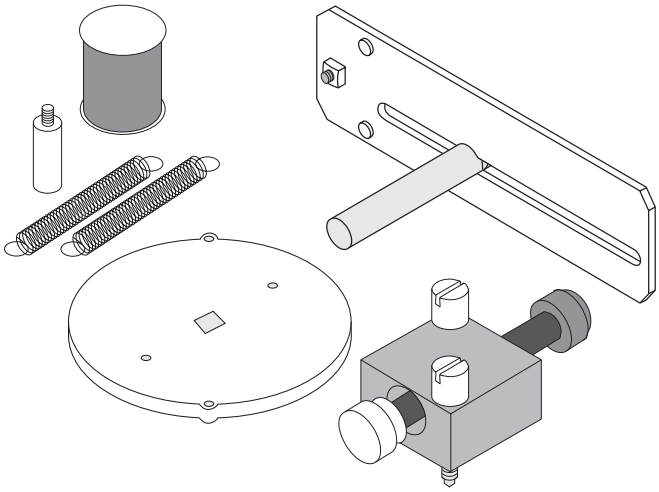
Linear Motion Accessory

The PASCO CI-6688 Linear Motion Accessory is a 21 cm long rack that is inserted into the t-slot in the side of the RMS to convert a linear motion into a rotary motion. The teeth on the rack engage a gear inside the RMS, causing it to rotate as the rack is pushed through the slot. The rack may be inserted into either side of the RMS. Sensors can be mounted to the rack using the rod clamp which can be attached to either end of the Linear Motion Accessory rack.

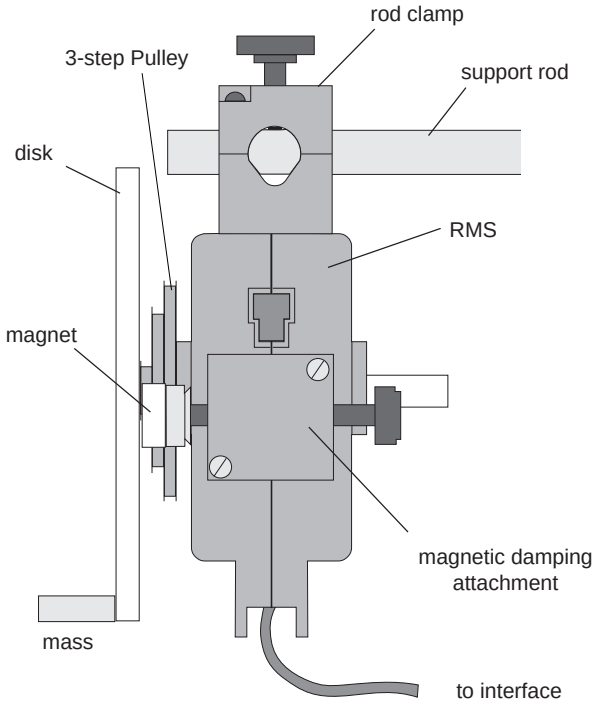


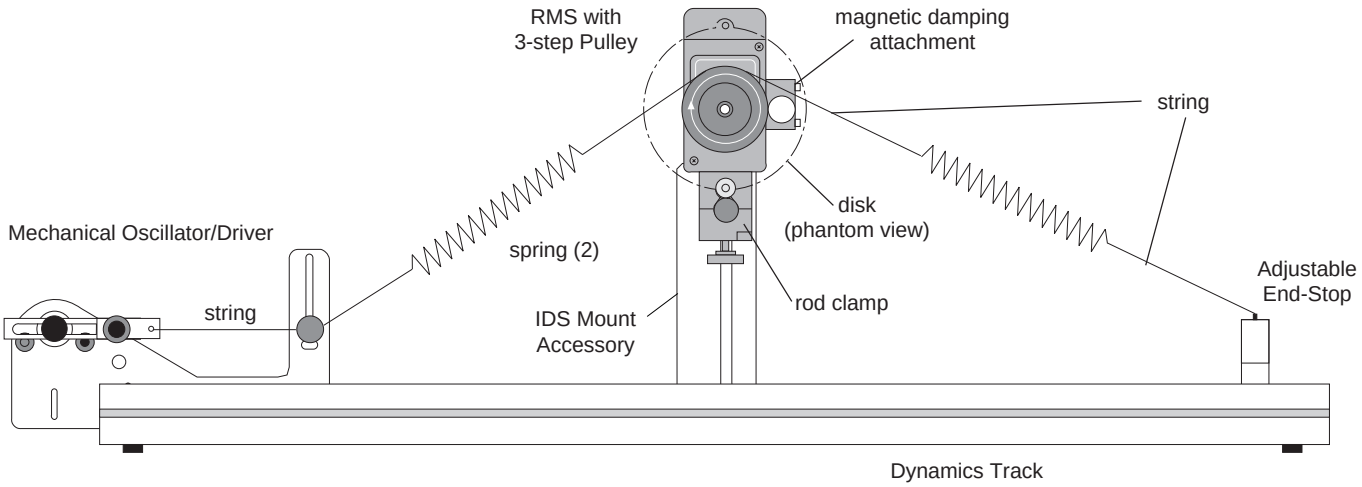
Chaos Accessory

The PASCO CI-6689 Chaos Accessory consists of an aluminum disk (identical to the one provided with the Mini-Rotational Accessory), a mass which attaches to the edge of the disk to form a physical pendulum, two springs for putting tension in the thread, a mounting bracket for mounting the RMS to the PASCO Introductory Dynamics System tracks (1.2 meter ME-9435A or 2.2 meter ME-9458), and an adjustable-gap magnet which attaches to the side of the RMS to provide variable magnetic damping. See the next page for diagram of the equipment setup.



The Chaos Accessory is a driven damped physical pendulum. Various types of phase plots can be made as the driving frequency, driving amplitude, initial conditions, and amount of damping are varied.

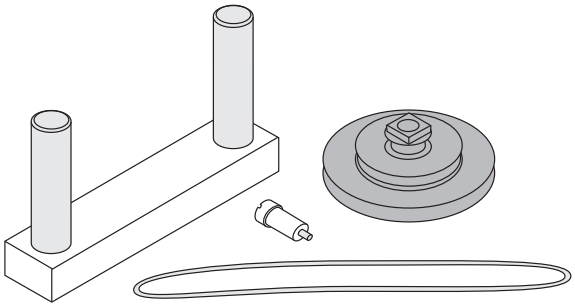




Chaos Accessory with Mechanical Oscillator on a Dynamics Track

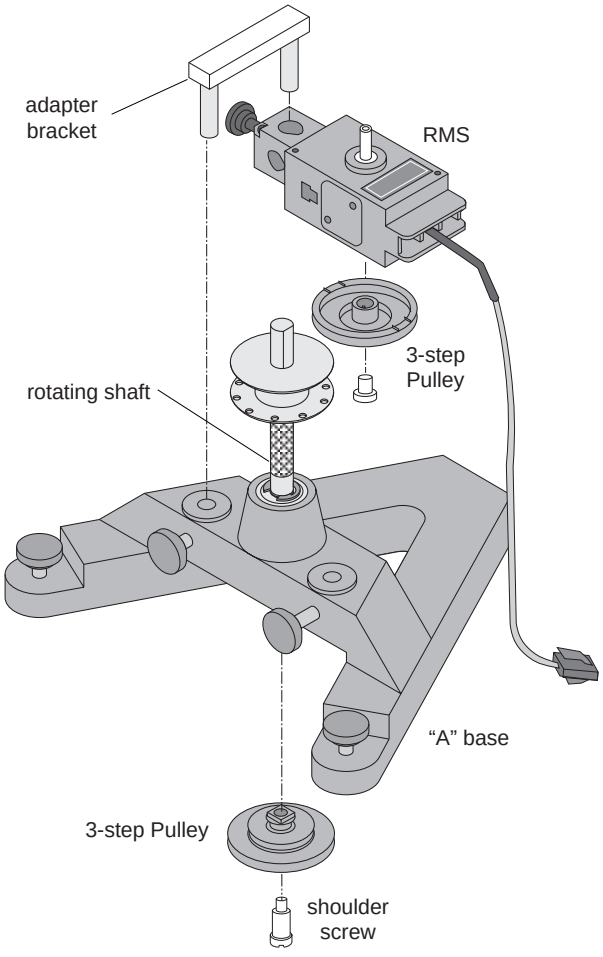
A PASCO ME-8750 Mechanical Oscillator/Driver is also required to drive the Chaos Accessory. The 1.2 m Dynamics Track is used as a convenient way to mount and align all the components. However, it is possible to mount the components on separate rod stands if a Dynamics Track is not available.

"A"-base Rotational Adapter

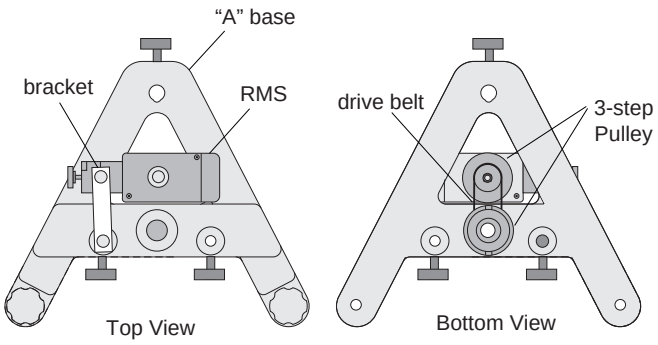


The CI-6690 "A"-base Rotational Adapter is used to mount the Rotary Motion Sensor to the "A" base of the ME-8951 Rotating Platform or the ME-8960 Gyroscope. The RMS provides higher resolution than a Smart Pulley, and precession of the Gyroscope can be plotted since the RMS keeps track of direction of rotation. The adapter includes a mounting bracket, a shoulder screw, a drive belt (o-ring), and a 3-step Pulley. The drive belt links the 3-step Pulley mounted on the "A" base to the 3-step Pulley on the RMS. For a one-to-one correspondence, connect the two pulleys using the o-ring on the middle step of each pulley. Each revolution of the Rotating Platform or Gyroscope corresponds to one revolution of the RMS. If desired, a 5-to-1 ration can be attained by putting the o-ring on the top or bottom steps.

The pulley attaches to the underside of the rotating shaft with the shoulder screw. Please note the pulley orientation illustrated below. The bracket connects to the "A" base of the Rotating Platform or the Gyroscope and to the RMS rod clamp.

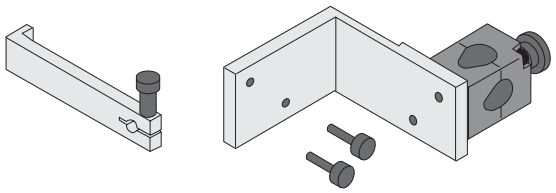


Assembling the RMS to the "A" Base

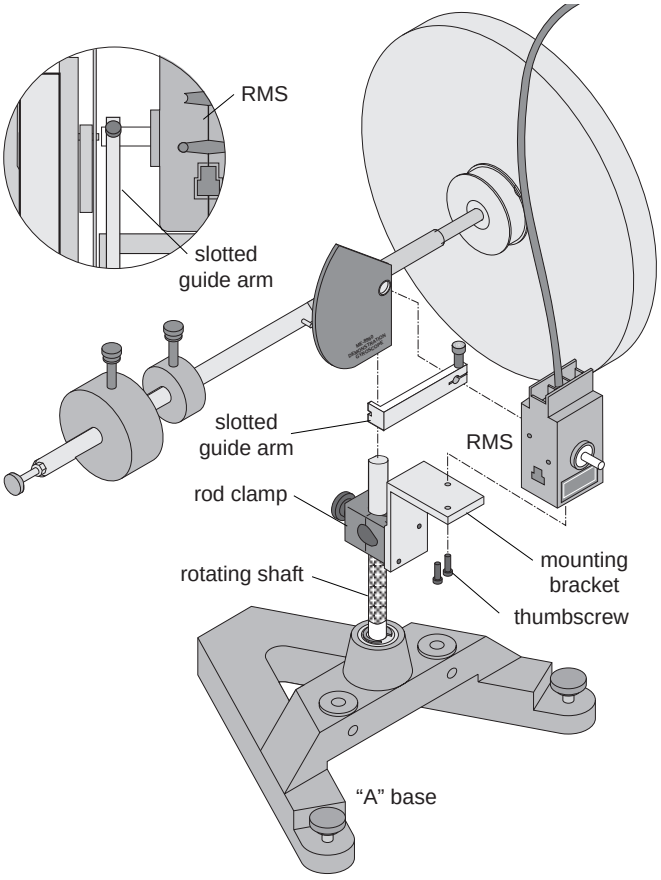


RMS Mounted on "A" Base

RMS/Gyroscope Mounting Bracket

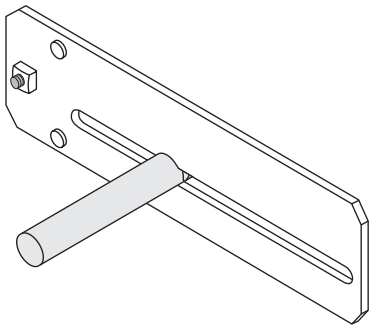


The PASCO ME-8963 RMS/Gyroscope Mounting Bracket attaches the Rotary Motion Sensor to the ME-8960 Gyroscope so the angle of nutation can be detected.

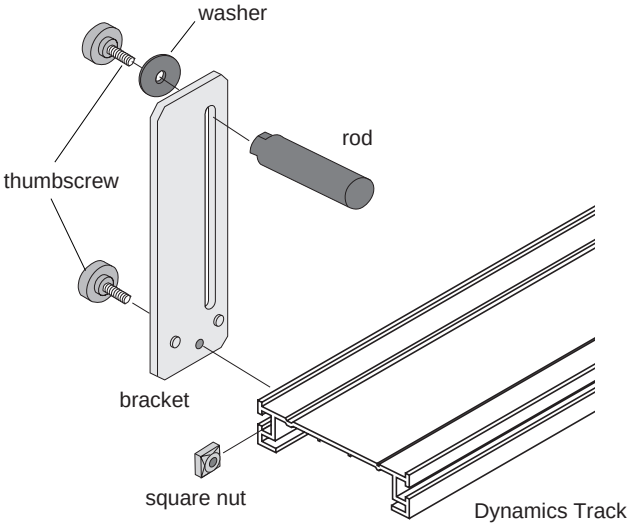


Assembling the RMS to the Gyroscope

IDS Mount Accessory

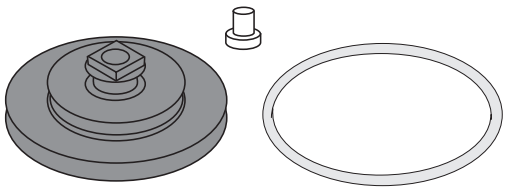


The PASCO CI-6692 IDS Mount Accessory is a bracket that allows the Rotary Motion Sensor to be easily attached to the Introductory Dynamics System tracks.



Attaching IDS Mount Accessory to Dynamics Track

3-step Pulley Accessory



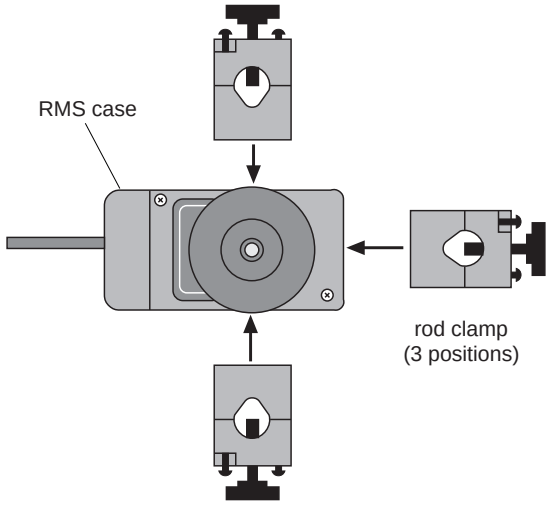
The PASCO CI-6693 3-step Pulley Accessory includes an additional pulley for mounting a 3-step Pulley on each end of the Rotary Motion Sensor rotating shaft. It also includes an o-ring.

General Setup and Operation

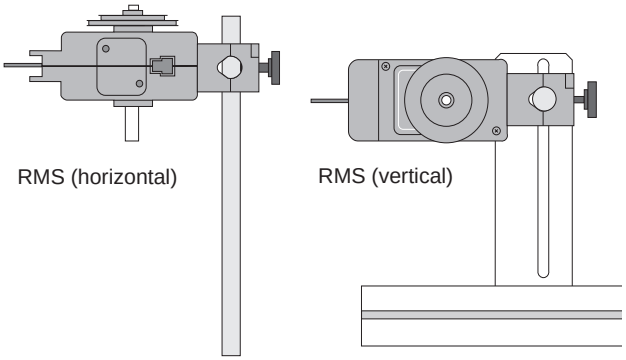
Mounting the RMS

Attaching the RMS to a Support Rod

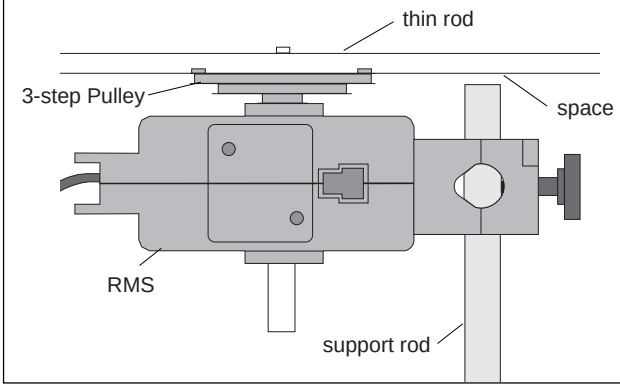
The Rotary Motion Sensor can be mounted on a support rod using the supplied rod clamp. The rod clamp can be mounted in three different locations on the Rotary Motion Sensor: at the end opposite the cable and on either side of the case. A Phillips screwdriver is required to remove the two screws that hold the rod clamp on the Rotary Motion Sensor case.



It is possible to mount the RMS horizontally on a support rod, with the 3-step Pulley facing up or vertically, with the pulley facing forward.

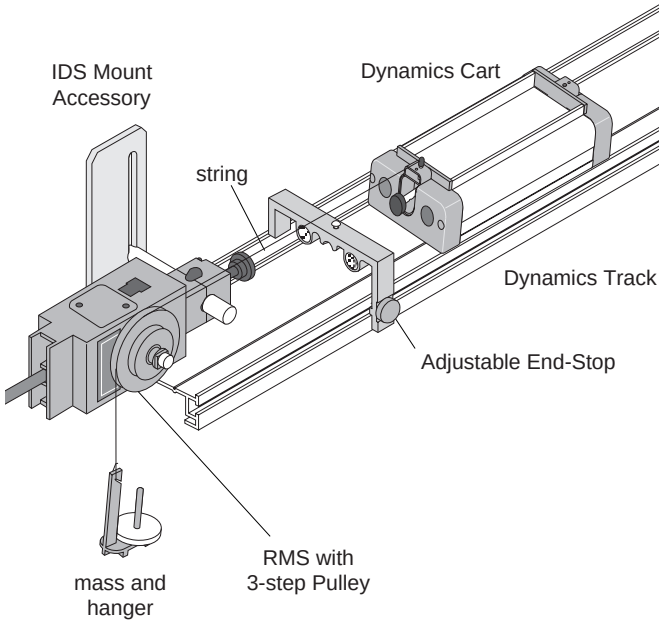


➤ **NOTE:** When setting up the rotational inertia experiment with the thin rod from the Mini-Rotational Accessory, the Rotary Motion Sensor must be mounted at the top of the support rod so the rod does not interfere with the rotation of the thin rod.



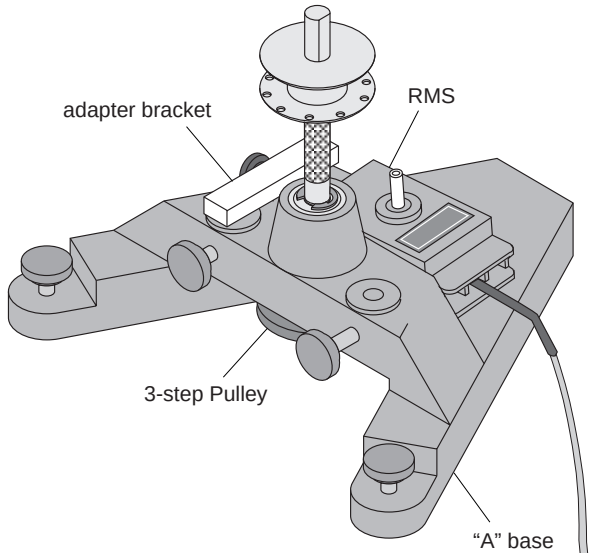
Attaching the RMS to a Dynamics Track

The Rotary Motion Sensor can be mounted to a Dynamics Track using the IDS Mount Accessory. The RMS mounts on the horizontal rod using the RMS rod clamp. The Rotary Motion Sensor can be used as a "Smart Pulley" in this configuration by threading a string over the Rotary Motion Sensor pulley and hanging a mass on the string.



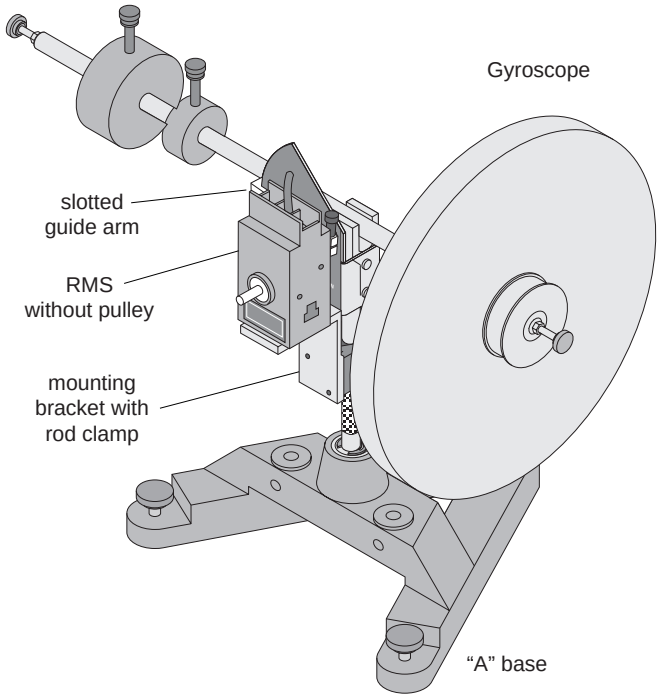
Attaching the RMS to the "A" base

The Rotary Motion Sensor can be mounted to the Rotating Platform or the Gyroscope using the "A"-base Rotational Adapter. This allows the precession angle of the Gyroscope to be detected.



Attaching the RMS to the Gyroscope

The Rotary Motion Sensor can be mounted to the Gyroscope using the RMS/Gyroscope Accessory. This allows the nutation angle of the Gyroscope to be detected.



Plugging the Rotary Motion Sensor Into The Computer Interface

To operate the Rotary Motion Sensor with the ULI, plug the modular phone plug from the Rotary Motion Sensor into port 2 on the ULI.

Refer to the ULI user's manual for details of the computer setup.

Setting the RMS Resolution

The required resolution depends on the rate at which the Rotary Motion Sensor will rotate during the experiment. In general, if the RMS will turn quickly during the experiment, the resolution should be 360 divisions per rotation so the data rate won't be too high. If the RMS will turn slowly and a finer resolution is needed, 1440 should be chosen.

Technical Support

Feed-Back

If you have any comments about this product or this manual please let us know. If you have any suggestions on alternate experiments or find a problem in the manual please tell us. PASCO appreciates any customer feed-back. Your input helps us evaluate and improve our product.

To Reach PASCO

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Contacting Technical Support

Before you call the PASCO Technical Support staff it would be helpful to prepare the following information:

- If your problem is computer/software related, note:

  Title and Revision Date of software.

  Type of Computer (Make, Model, Speed).

  Type of external Cables/Peripherals.

- If your problem is with the PASCO apparatus, note:

  Title and Model number (usually listed on the label).

  Approximate age of apparatus.

  A detailed description of the problem/sequence of events. (In case you can't call PASCO right away, you won't lose valuable data.)

  If possible, have the apparatus within reach when calling. This makes descriptions of individual parts much easier.

- If your problem relates to the instruction manual, note:

  Part number and Revision (listed by month and year on the front cover).

  Have the manual at hand to discuss your questions.