*Instruction Manual for the PASCO scientific Model OS-8535*

012-06551A
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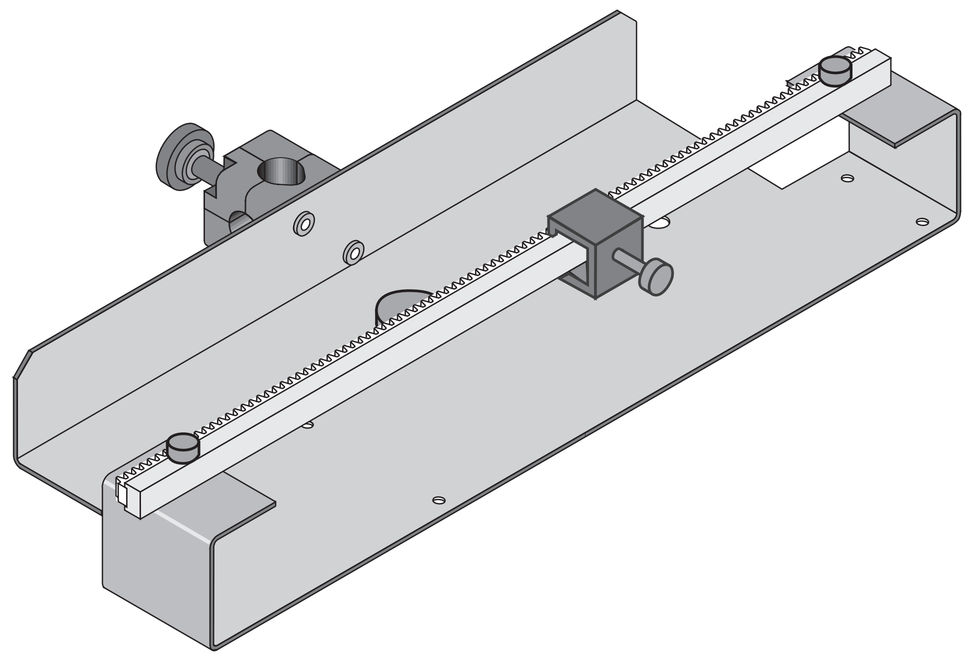
# LINEAR TRANSLATOR

## FOR THE BASIC OPTICS SYSTEM





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## Credits

This manual authored by: Dave Griffith

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

② Make certain there is 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 can not shift in the box, or become compressed, thus letting the instrument come in contact with the edge of the box.

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# Introduction

The PASCO OS-8535 Linear Translator is designed to be mounted on the Optics Bench of the OS-8515 Basic Optics System. The Linear Translator can also be mounted on a rod up to 0.5 inch (12 mm) diameter.

## Description

The Linear Translator consists of a base with mounting hardware and an attached rod clamp, a rack, and a rack clamp. The hole in the base allows it to be stored on a peg. The mounting hardware on the base consists of a thumbscrew and a square nut. The nut fits into the T-slot in the center of the Optics Bench (part of the OS-8515).

The rack is attached to the top of the base with two thumbscrews. The rack is designed to fit inside the T-slot on the side the PASCO Model CI-6538 Rotary Motion Sensor (or CI-6625 Rotary Motion Sensor for ULI). The teeth on the rack engage a gear inside the Rotary Motion Sensor, causing the gear to rotate when the Rotary Motion Sensor moves along the rack. The Rotary Motion Sensor measures its linear position along the rack.

The rack clamp is attached to the back of the rack with a thumbscrew. The clamp sets the initial or final position of the Rotary Motion Sensor.

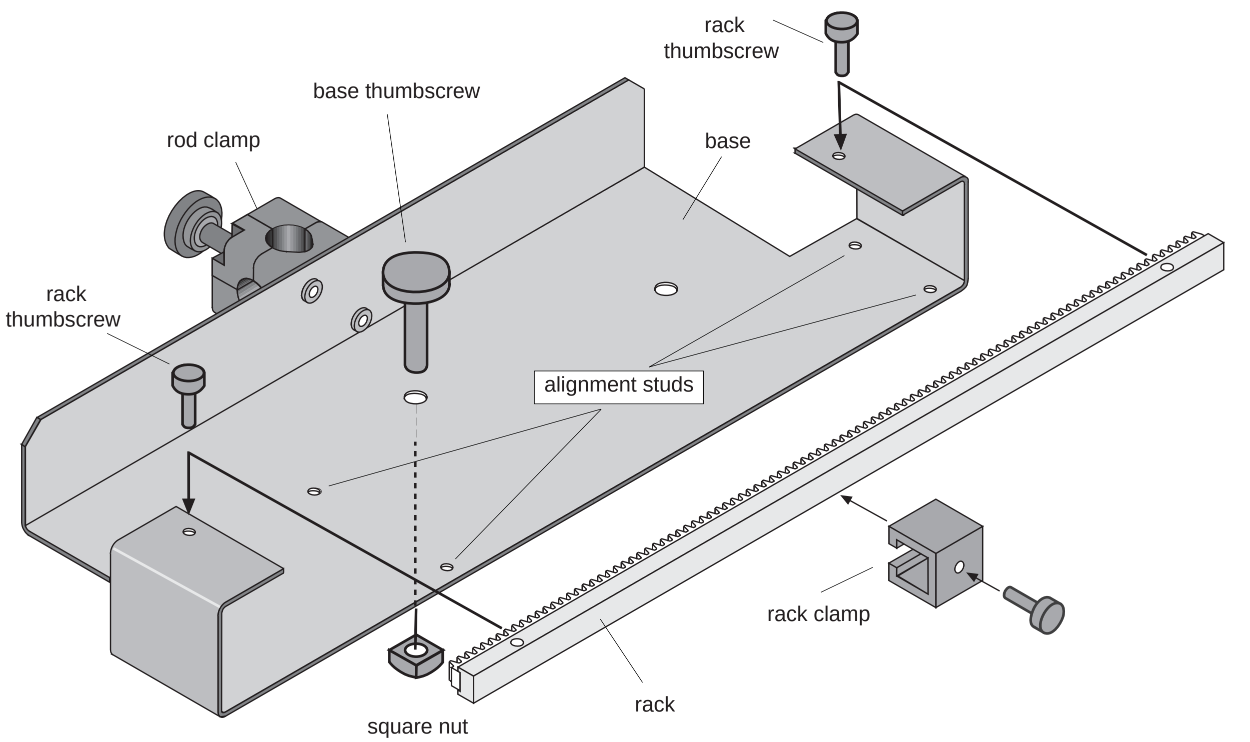


Figure 1: Linear Translator for Basic Optics

## Mounting the Linear Translator on the Optics Bench

You can mount the Linear Translator on the Optics Bench in two ways: with the Rack perpendicular to the Optics Bench or with the Rack parallel to the Optics Bench.

### Pependicular Mount

To mount the Linear Translator so the Rack is perpendicular, leave the mounting hardware (thumbscrew and square nut) in the center hole. Loosen the thumbscrew by turning the thumbscrew counter-clockwise while holding the square nut. Leave the square nut on the end of the thumbscrew.

Attach the base to the Optics Bench by inserting the square nut into the T-slot located along the *center* of the Optics Bench. Use the two widely spaced alignment studs on the underside of the base to align the Linear Translator with the edge of the Optics Bench.

The Linear Translator can be moved to any position along the Optics Bench while the thumbscrew is loose. Tighten the thumbscrew to secure the Linear Translator in position.

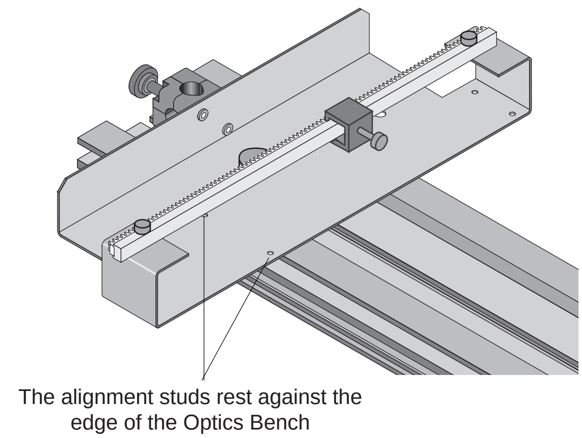


Figure 2: Linear Translator on Optics Bench

### Parallel Mount

To mount the Linear Translator so the Rack is parallel to the Optics Bench, move the mounting hardware from the center hole to the off-center hole (see Figure 3.1).

Turn the Linear Translator so the Rack is parallel to the Optics Bench. Insert the square nut into the T-slot located along the center of the Optics Bench.

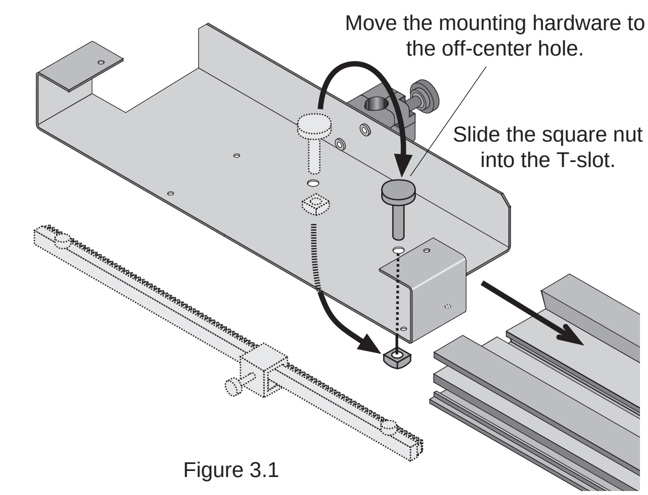


Figure 3.1

## Using a Rotary Motion Sensor

You can mount a PASCO Model CI-6538 Rotary Motion Sensor or the Model CI-6625 Rotary Motion Sensor for ULI on the rack of the Linear Translator.

The Rotary Motion Sensor has a T-slot into which you can slide the Rack of the Linear Translator. The first step is to remove the rack thumbscrews from the ends of the Rack. Turn the thumbscrews counter-clockwise to remove them.

You may also want to remove the Rack Clamp from the Rack. Turn the rack thumbscrew counter-clockwise until you can slide the Rack Clamp off the end of the Rack.

If you are using the three-step pulley on the Rotary Motion Sensor, hold the Rotary Motion Sensor so the three-step pulley is on top. Line up the Rack with the T-slot on the side of the Rotary Motion Sensor. The teeth on the Rack go through the narrow side of the T-slot and then engage a gear that is on the shaft of the Rotary Motion Sensor. Gently push the Rack through the T-Slot and into the sensor.

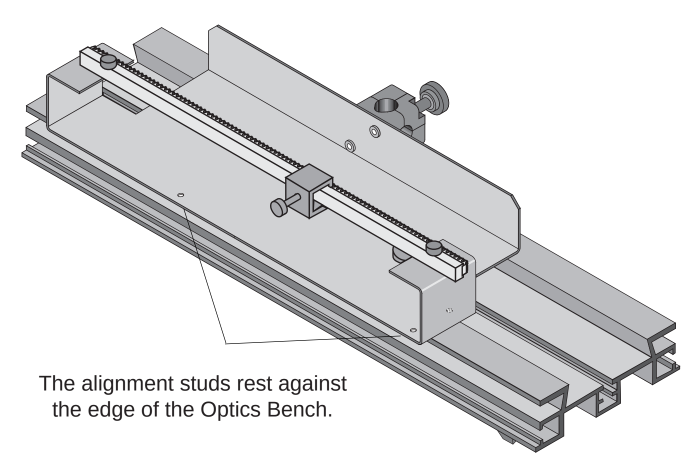


Figure 3.2: Linear Translator Parallel to Optics Bench

When the Rack is in the T-slot, put the Rack Clamp back onto the Rack and tighten its thumbscrew. Place the Rack with the sensor back onto the Linear Translator. The back end of the Rotary Motion Sensor rests on the up-right edge of the base of the Linear Translator. Line up the holes in the ends of the Rack with the holes on the Linear Translator base. Put the thumbscrews into the holes and turn them clockwise to tighten.

If the Linear Translator is mounted parallel to the Optics Bench, move the rod clamp from the end of the Rotary Motion Sensor to the side of the Rotary Motion Sensor. By doing this, the Light Sensor will be along the center line of the Optics Bench when you put the Aperture Bracket post into the rod clamp of the Rotary Motion Sensor.

You will need a Phillips head screwdriver with a small tip (e.g., #0). Use the screwdriver to remove the two screws from the end of the rod clamp. Align the rod clamp with the threaded holes on the side of the Rotary Motion Sensor. Replace the screws.

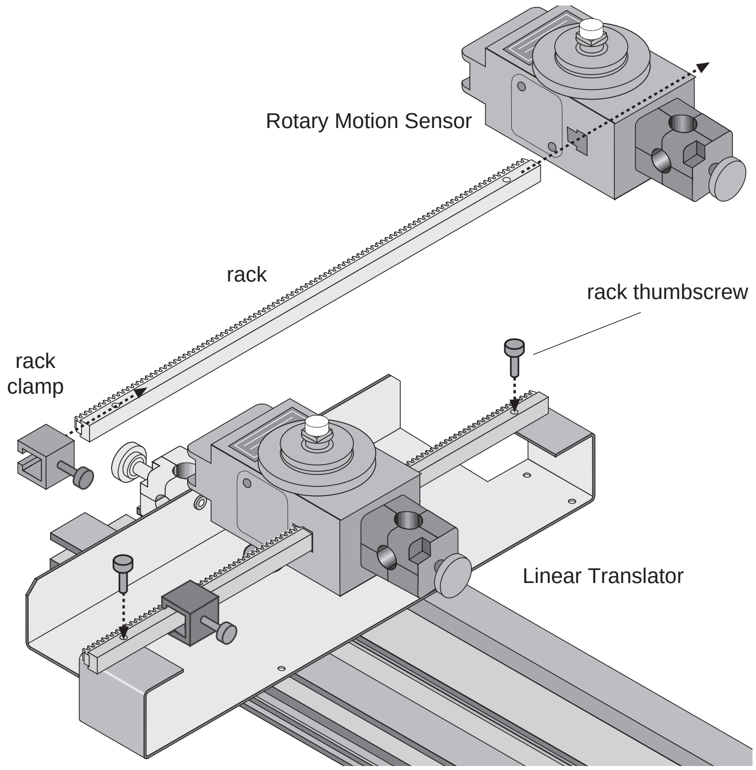

Figure 4.1: Rotary Motion Sensor onto Linear Translator

## Using the Rack Separately

The rack of the Linear Translator can be used separately from the Linear Translator. For example, it can be an accessory to the Rotary Motion Sensor in experiments that do not require the Optics Bench but that do require the measurement of linear position.

Remove the two rack thumbscrews. Remove the rack clamp from the rack. Use a Phillips head screwdriver with a small tipe (e.g., #0) to remove the two screws from the end of the rod clamp that is on the Linear Translator. Use one of the rack thumbscrews to attach the rod clamp to one end of the rack as shown. Use the rod clamp to hold sensors, etc.

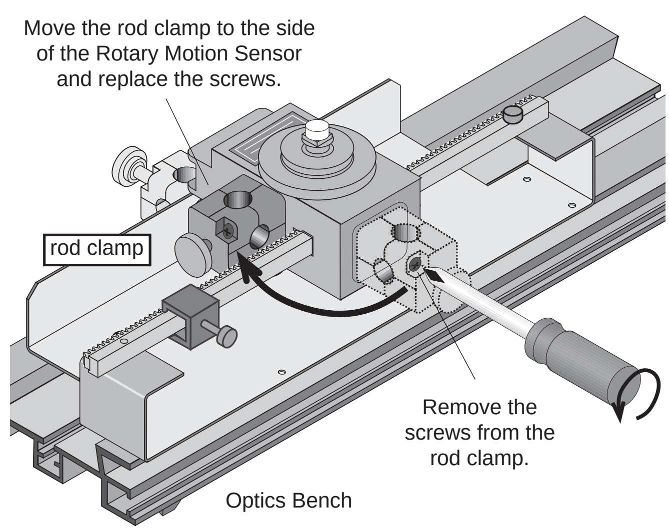

Figure 4.2: Rotary Motion Sensor on Linear Translator Parallel to Optics Bench

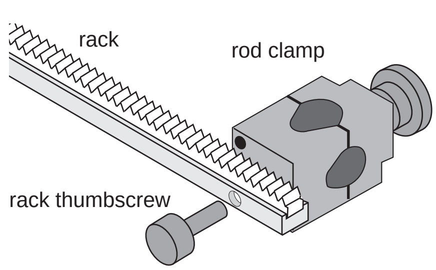

Figure 5: Rod Clamp attached to Rack

## Suggestions for Using the Linear Translator

### Light Intensity of Diffraction Patterns

**EQUIPMENT NEEDED**

– Optics Bench (part of OS-8515)
– Aperture Bracket (OS-8534)
– Diode Laser (OS-8525)
– Light Sensor (CI-6504A)
– Linear Translator (OS-8535)
– Slit Accessory (OS-8523)
– Rotary Motion Sensor (CI-6538)

Use the Diode Laser and Slit Accessory to produce a diffraction pattern. Mount the Linear Translator on the Optics Bench so the rack is *perpendicular* to the Optics Bench. Use the Light Sensor to measure the intensity of light in the diffraction pattern. Use the Rotary Motion Sensor mounted on the Linear Translator to measure the position of the Light Sensor as it moves through the diffraction pattern.

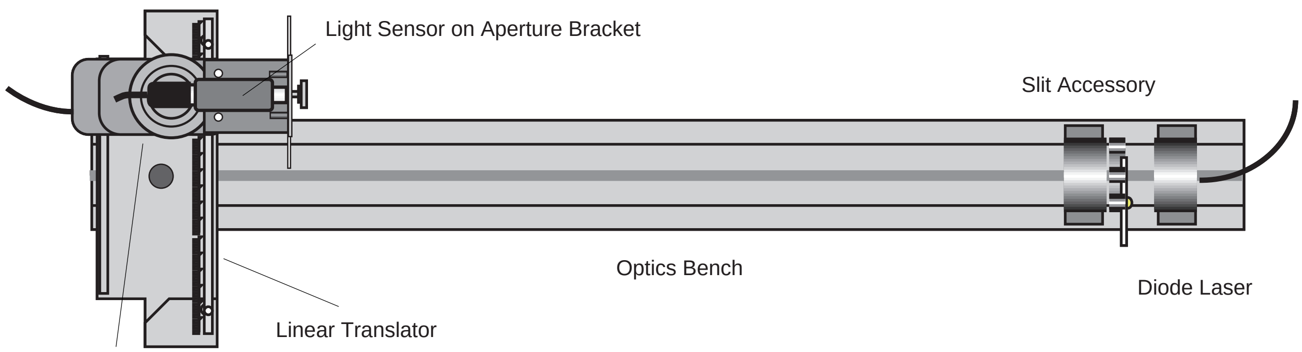


Figure 6: Light Intensity of Diffraction Patterns

(The description for this experiment starts on the next page.)

### Light Intensity versus Distance

**EQUIPMENT NEEDED**

– Optics Bench (part of OS-8515)
– Aperture Bracket (OS-8534)
– Rotary Motion Sensor (CI-6538)
– Linear Translator (OS-8535)
– Light Source (part of OS-8515)
– Light Sensor (CI-6504A)

Use the Light Source to produce a “point source” of light. Mount the Linear Translator on the Optics Bench so the rack is *parallel* to the Optics Bench. Use the Light Sensor to measure the intensity of the light. Use the Rotary Motion Sensor mounted on the Linear Translator to measure the position of the Light Sensor as it moves relative to the Light Source.

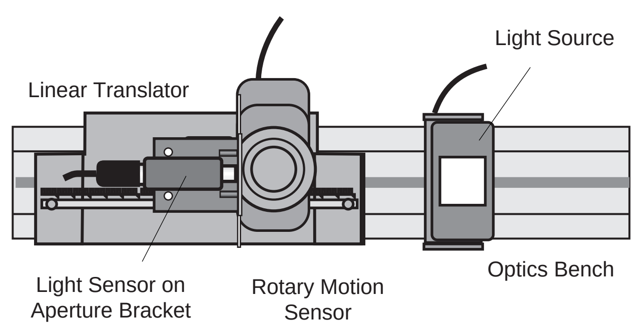


Figure 7: Light Intensity versus Distance

# Set Up for a Diffraction Pattern Experiment

**EQUIPMENT NEEDED**

– Optics Bench (part of OS-8515)
– Aperture Bracket (OS-8534)
– Diode Laser (OS-8525)
– Light Sensor (CI-6504A)
– Linear Translator (OS-8535)
– Slit Accessory (OS-8523)
– Rotary Motion Sensor (CI-6538)

## Introduction

The purpose is to investigate the wave nature of light. A Light Sensor measures the intensity of the interference pattern created by monochromatic laser light passing through a single or multiple slit. The Rotary Motion Sensor mounted on the Linear Translator measures the relative positions of the maxima in the pattern.

## Procedure

1. Put the Linear Translator onto the Optics Bench so the rack is perpendicular to the Optics Bench. Mount the Rotary Motion Sensor onto the Rack of the Linear Translator as described in the Introduction. Remove the "O" ring and thumbscrew from the Rotary Motion Sensor pulley as shown in Figure 1 so they will not interfere with the Aperture Bracket.

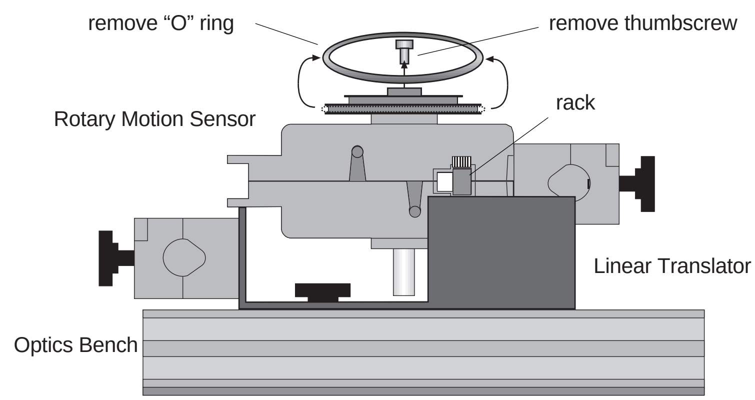

Figure 1

2. Mount the Light Sensor onto the Aperture Bracket by screwing the Aperture Bracket post into the threaded hole on the bottom of the Light Sensor as shown.
3. Put the post into the rod clamp on the end of the Rotary Motion Sensor. Lower the Aperture Bracket until it rests on the top of the Rotary Motion Sensor. Tighten the Rod Clamp thumbscrew to hold the Aperture Bracket and Light Sensor in place.

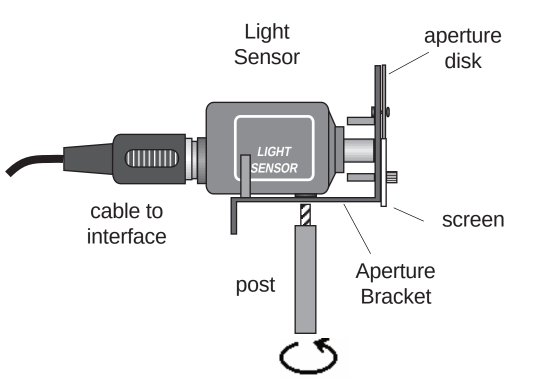

Figure 2

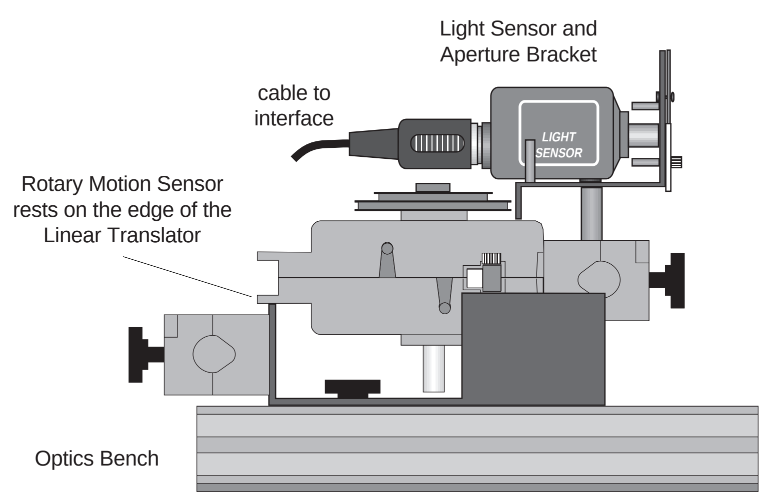

Figure 3

4. Mount the Diode Laser and a Slit Accessory at the other end of the Optics Bench. For example, put the MULTIPLE SLIT SET into the Slit Accessory holder.
5. Plug in the power supply for the Diode Laser. Turn on the laser.
6. Rotate the SLIT SET disk on the Slit Accessory until a slit pattern is in line with the laser beam. Use the adjustment screws on the back of the Diode Laser to adjust the beam if necessary.

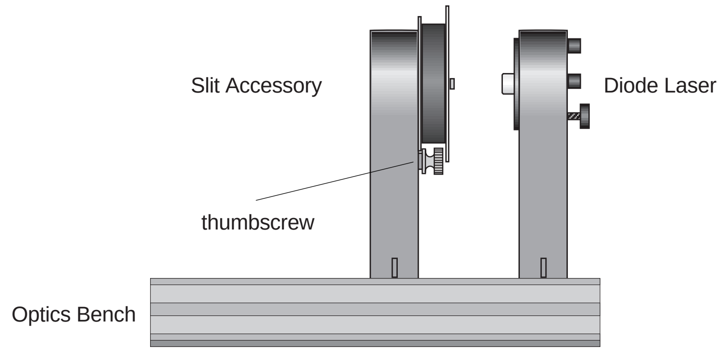

Figure 4

7. Rotate the pulley on the top of the Rotary Motion Sensor to move it along the rack on the Linear Translator. Move the Rotary Motion/Light Sensor until the white screen on the front of the Aperture Bracket shows the diffraction pattern.
8. Examine the diffraction pattern on the white screen. If the pattern is not horizontal, loosen the thumbscrew on the Slit Accessory. Slowly rotate the Slit Accessory until the laser beam is *centered* on the slit pattern you want and the diffraction pattern is *horizontal* on the white screen on the Aperture Bracket. Tighten the thumbscrew on the Slit Accessory to hold it in place.
9. Rotate the Aperture Disk on the front of the Aperture Bracket until the narrowest slit opening is in front of the Light Sensor opening. This reduces the amount of ambient light that can enter the Light Sensor while the Light Sensor is between maxima of the diffraction pattern.
10. Move the Rotary Motion Sensor/Light Sensor along the rack on the Linear Translator until the *center* of the difffraction pattern is aligned with the center of the narrow slit on the Aperture Disk of the Aperture Bracket. Loosen the Rotary Motion Sensor rod clamp and adjust the Aperture Bracket and Light Sensor up or down if necessary.

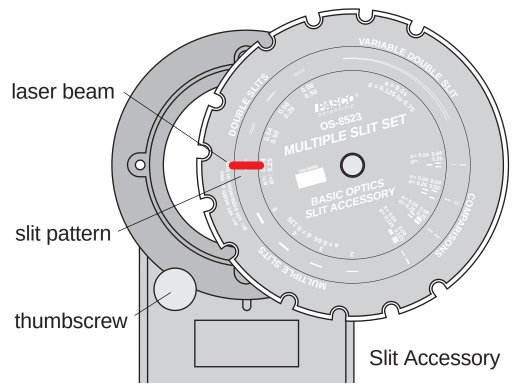

Figure 5

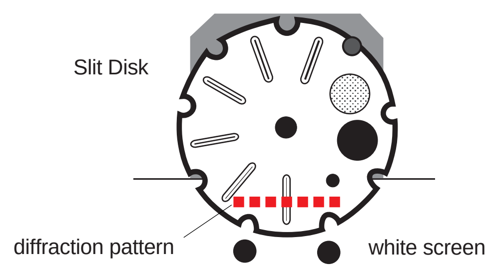

Figure 6

## *Data Recording*

Refer to Physics Labs with Computers, Volume 2, (PASCO Model CI-7010) for information about data recording using a *ScienceWorkshop* interface.

# Technical Support

## Feedback

If you have any comments about the product or 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 all customer feedback. Your input helps us evaluate and improve our product.

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  If possible, have the apparatus within reach when calling to facilitate description of individual parts.

- 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.