Instruction Manual and Experiment Guide for the PASCO scientific Model ME-6805

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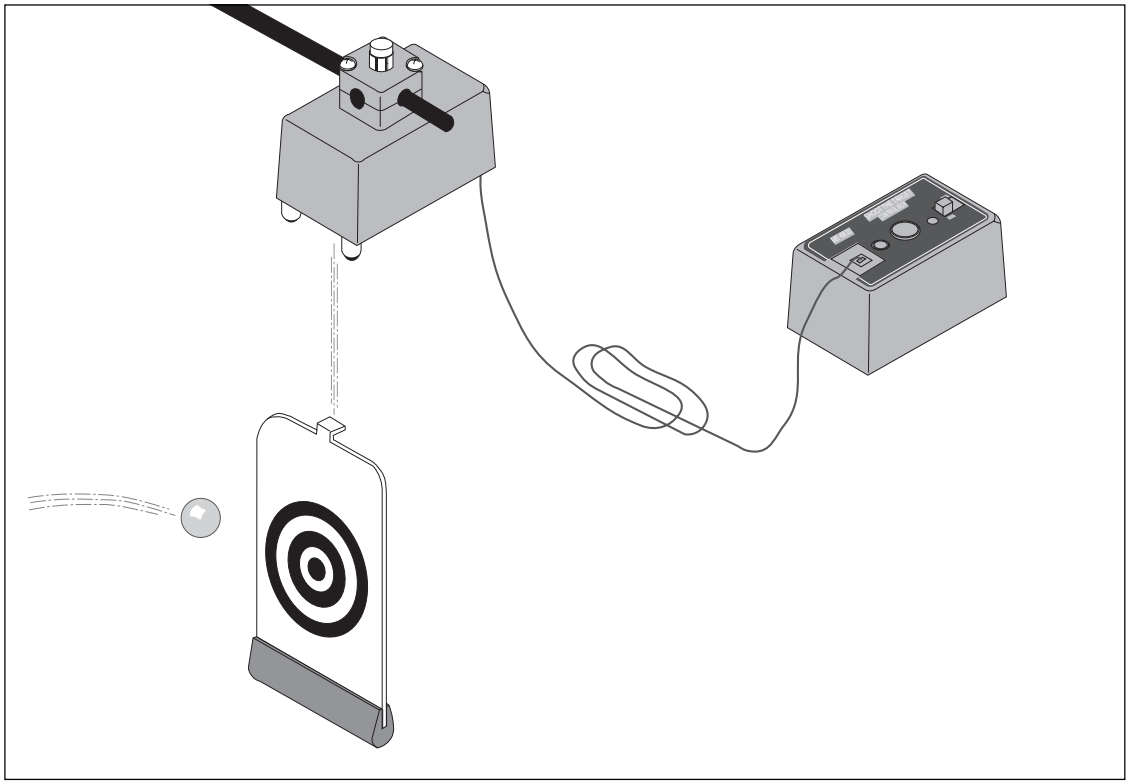
SHOOT THE TARGET ACCESSORY



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PASCO scientific warrants the product to be free from defects in materials and workmanship for a period of one year from the date of shipment to the customer. PASCO will repair or replace at its option any part of the product which is deemed to be defective in material or workmanship. The warranty does not cover damage to the product caused by abuse or improper use. Determination of whether a product failure is the result of a manufacturing defect or improper use by the customer shall be made solely by PASCO scientific. Responsibility for the return of equipment for warranty repair belongs to the customer. Equipment must be properly packed to prevent damage and shipped postage or freight prepaid. (Damage caused by improper packing of the equipment for return shipment will not be covered by the warranty.) Shipping costs for returning the equipment after repair will be paid by PASCO scientific.

Credits

Author: Jon Hanks
Editor: Sunny Bishop

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 ME-6805 Shoot the Target Accessory is used with the PASCO Projectile Launchers (either the short range ME-6800, long range ME-6801, or demonstration model ME-6823) to perform the classic Monkey and Hunter demonstration. This version has the following features:

- Photogate trigger:

  When the ball leaves the end of the Launcher, it passes through a photogate, blocking the infrared beam, which sends a signal to the Drop Box to drop the target.

- No power needed to hold target:

  The target is suspended by a permanent magnet. When the signal from the Control Box arrives at the Drop Box when the ball is launched, a coil produces a magnetic field which momentarily cancels the magnetic field of the permanent magnet. This causes the target to drop.

- Bore sights:

  The Projectile Launcher has two sights inside it so the Launcher can be aimed directly at the target by sighting down the barrel of the Launcher. Please note that the PASCO OS-8527 Laser Sight is available as an accessory to the launcher. It mounts on the launcher and makes alignment easier than using the bore sights.

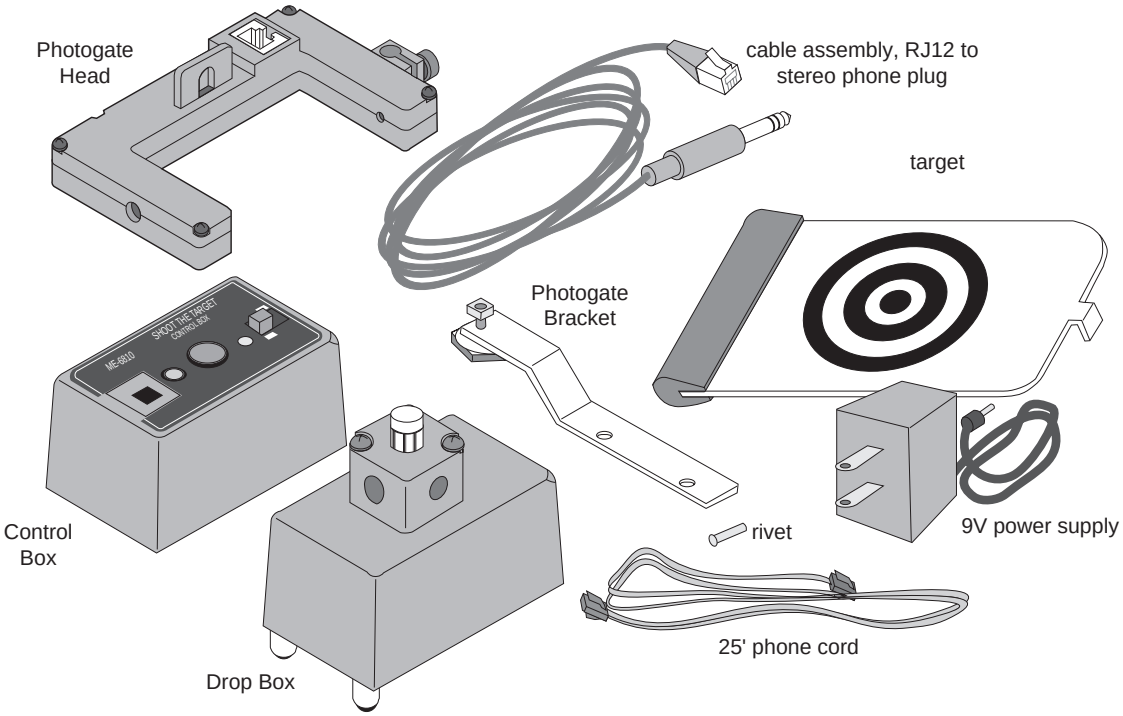
- Customize the ready-made target:

  Customize the target by taping the supplied target pattern, a photograph, or a drawing to the flat target. Alternatively, use almost any object that has a piece of iron on it that will hold the object on the magnet. Be sure the piece of iron is small enough to just hold the object on the magnet; if the iron piece is too big, the attraction will be too large, the iron piece will take longer to demagnetize, and the target will be delayed in falling.

- Long or short range:

  This demonstration can be performed using any of the range settings of the Projectile Launcher.

Equipment



How It Works

The Shoot the Target Accessory consists of two main parts: the Control Box and the Drop Box. See Figure 1.

Control Box

The Control Box is positioned next to the Projectile Launcher on the table. The power is connected to this box. The photogate that acts as the target release trigger is connected to this box. There is also a switch that arms and disarms the photogate trigger. When the switch is in the ARM position, the next time the photogate beam is blocked, the target will be dropped. When the switch is in the DISARM position, the photogate is inoperative so the ball can be loaded into the barrel without causing the target to be dropped prematurely.

Drop Box

The Drop Box is suspended from the ceiling and the target is hung from this box. Inside the box is a neodymium magnet attached to an iron core that has a coil wrapped around it. The metal target is attracted to the end of the core that protrudes from the box. The Drop Box is attached with a phone cord to the Control Box. The Control Box supplies power to charge the capacitor that is inside the Drop Box. When the signal from the photogate is received from the Control Box, the capacitor in the Drop Box is discharged through the coil, producing a magnetic field opposite to the magnetic field of the Neodymium magnet. When the field is canceled momentarily, the target drops.

Mounting the Drop Box:

The Drop Box can be mounted by one of two methods, depending on the means available in the classroom.

① Clamp the rod clamp to a standard 1/2"-rod.

or

② Attach the neodymium magnet which is affixed to the knurled thumbscrew in the rod clamp to any magnetic ceiling area in the classroom.

NOTE: Securing the apparatus with the rod clamp is the more secure method.

Other equipment included:

- 25' phone cord with modular connectors (each end)
- 9VDC 115/220 VAC Adapter
- 6"x8" Magnetic target
- Photogate Head with cable assembly (ME-9498A)
- Photogate Mounting Bracket (ME-6821)
- Spare 1/8" diameter rivet (to make your own target)

Additional equipment required:

- Projectile Launcher (ME-6800/ME-6801/ ME-6823) with plastic ball
- Rod (to attach Drop Box to ceiling)

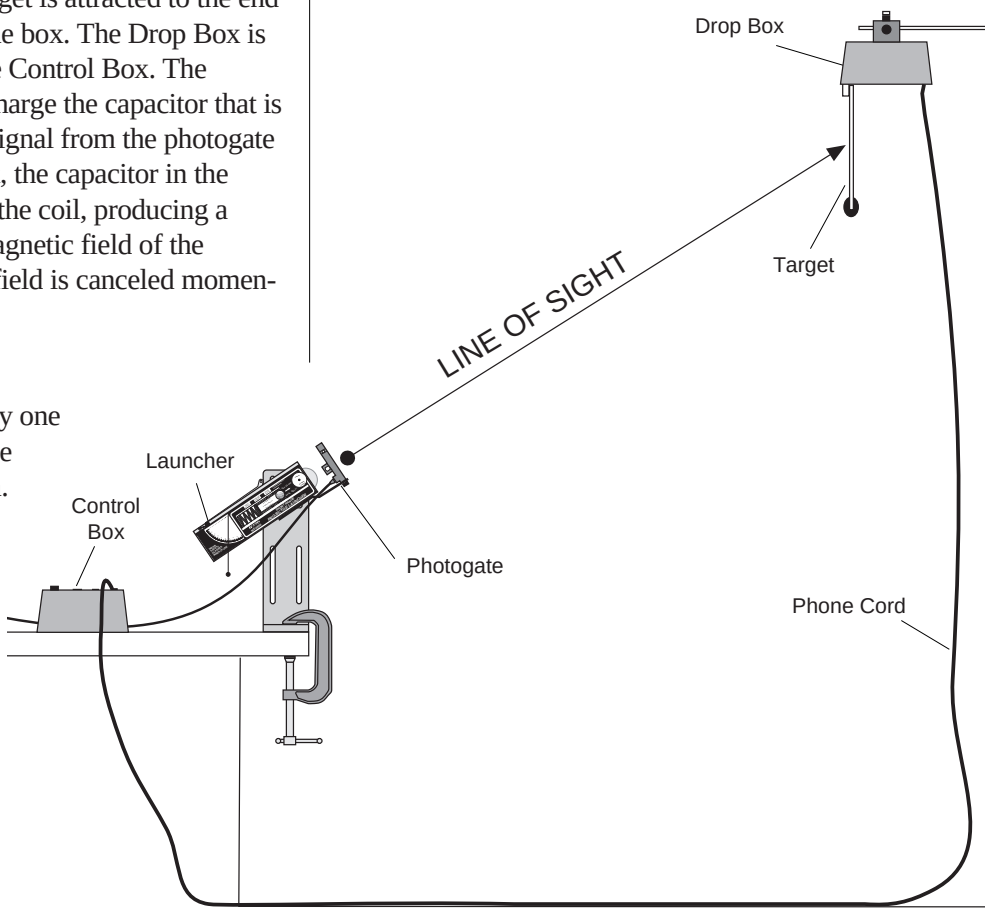


Figure 1: Demonstration Set Up

Experiment: Shoot the Target

Theory

The ball will hit the falling target if the Launcher is aimed directly at the hanging target. See Figure 2. The equations for the vertical motions of the target and the ball are

Target: $\mathbf{y = h - (1/2)gt^2}$

Ball: $\mathbf{y = v_o \sin \theta\ t - (1/2)gt^2}$

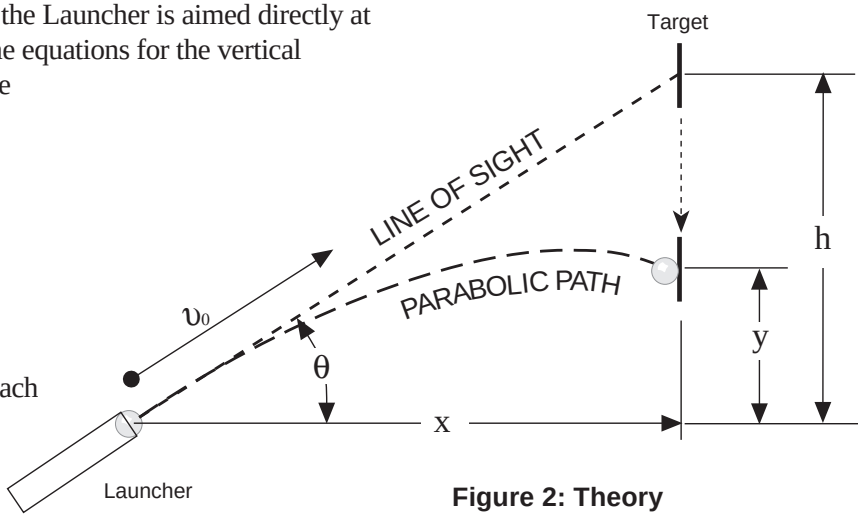


Figure 2: Theory

Setting the two equations equal to each other gives $h = v_o \sin \theta\ t$. Solving for the time gives $t = h/(v_o \sin \theta)$. Substituting this time into the equation for the horizontal distance traveled by the ball $x = v_o \cos \theta\ t$, gives $x = h/\tan \theta$. Solving for the angle shows that the launcher must be aimed directly at the hanging target: $\tan \theta = h/x$.

Setup

① Clamp the Projectile Launcher to a sturdy table.

② Mount the photogate bracket on the Projectile Launcher and mount the photogate in the hole nearest the muzzle. Adjust the bracket so the ball will block the photogate beam as it leaves the end of the launcher.

③ Plug the photogate into the Control Box.

④ Plug the provided power supply into the Control Box.

⑤ Test fire the launcher to see approximately how far away to mount the Drop Box.

⑥ To mount the Drop Box to the ceiling, either hang the box by its clamp to a rod that is attached in some manner to your ceiling, or hang it from the clamp magnet to a magnetic ceiling surface. Attach the Drop Box so the magnet for holding the target faces down.

⑦ Connect the Drop Box to the Control Box by plugging the ends of the provided phone cord into each box.

⑧ Hang the target from the Drop Box. The metal on the target is held magnetically to the Drop Box. Orient the target so it faces the launcher and the upper edge is trapped behind the overhanging screws on the Drop Box (See Figure 3). This prevents the target from rotating.

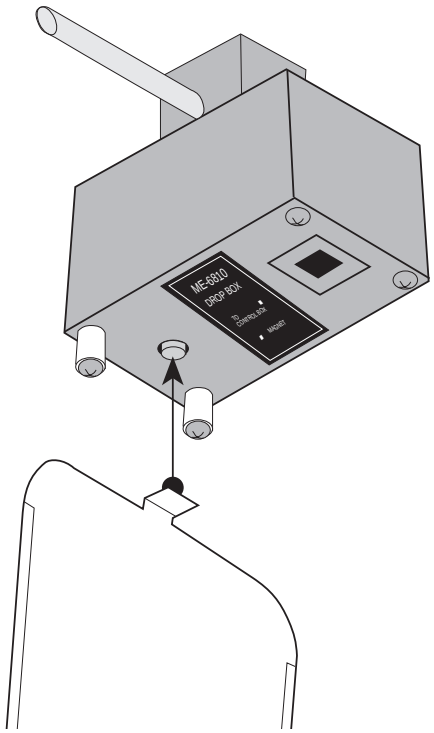


Figure 3: Attaching Target to Drop Box

Procedure

① Aim the launcher at the center of the hanging target. To do this, look through the launcher from the back end and adjust the angle of the launcher so the centers of the sights inside the launcher are aligned with the center of the target.

> ➤ **NOTE**: If the Laser Sight is used for alignment, please follow the instructions that come with the Laser Sight to properly align the launcher with the target.

② Load the launcher: First, disarm the photogate by switching the Control Box to DISARM so the target will not be dropped accidentally when the ball is loaded. Put the ball in the launcher and cock the launcher.

③ Flip the switch on the Control Box to arm the photogate. The LED should be on, indicating that the target will be dropped the next time the photogate is blocked.

④ Launch the ball. The ball will hit the falling target.

Target Pattern

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 any customer feedback. Your input helps us evaluate and improve our product.

To Reach PASCO

For technical support, call us at 1-800-772-8700 (toll-free within the U.S.) or (916) 786-3800.

fax: (916) 786-3292

e-mail: techsupp@pasco.com

web: www.pasco.com

Contacting Technical Support

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

➤ 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 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.