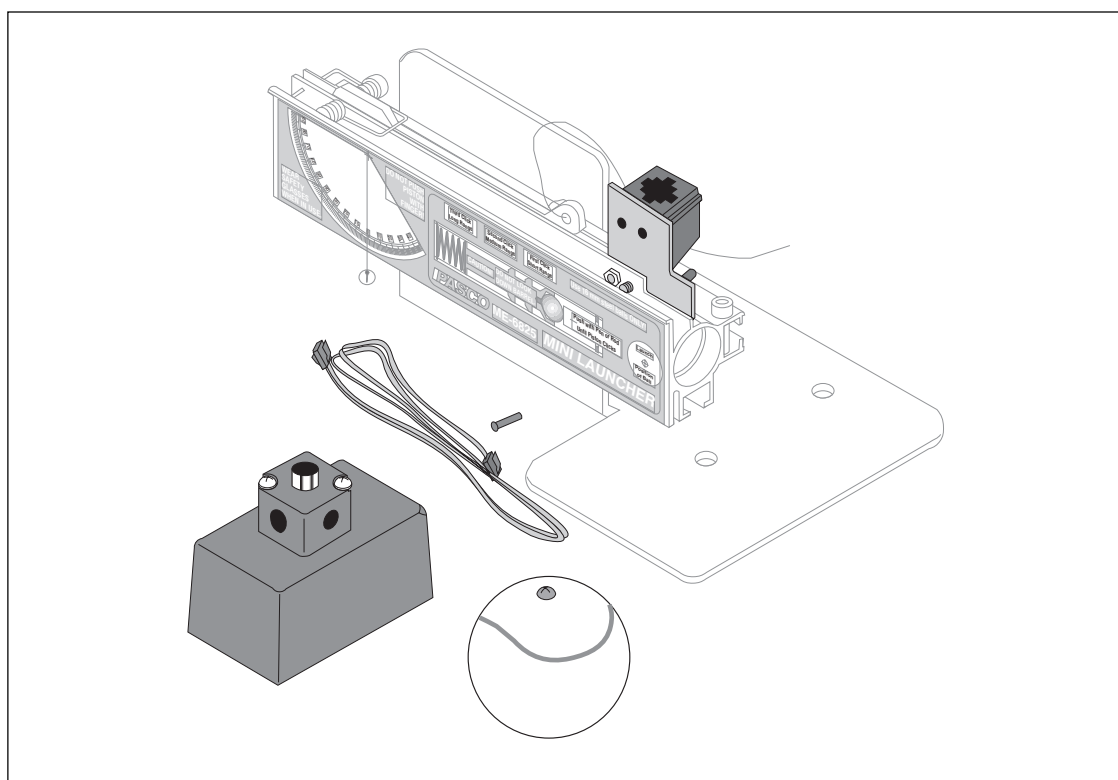


**Instruction Manual and  
Experiment Guide for  
the PASCO scientific  
Model ME-6826**

012-05488A  
2/95

# **SHOOT THE TARGET II ACCESSORY**



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10101 Foothills Blvd. • P.O. Box 619011 • Roseville, CA 95678-9011 USA  
Phone (916) 786-3800 • FAX (916) 786-8905 • email: techsupp@PASCO.com

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# Copyright, Warranty and Equipment Return

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PASCO scientific warrants this 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. This 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

This manual authored by: Jon Hanks

## Equipment Return

Should this product have to be returned to PASCO scientific, for whatever reason, notify PASCO scientific by letter or phone 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.

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 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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10101 Foothills Blvd.  
P.O. Box 619011  
Roseville, CA 95678-9011

Phone: (916) 786-3800

FAX: (916) 786-8905

## Introduction

The ME-6826 Shoot the Target II Accessory is designed specifically for use with the ME-6825 Mini Launcher to perform the classic Monkey and Hunter demonstration on a table top. This version has the following features:

- **Microswitch:**

The switch is triggered by the piston in the launcher, not the ball. This sends a signal to the Drop Box to drop the target without affecting the ball's flight.

- **No power needed to hold target:**

The target is suspended by a permanent magnet. When the ball is shot, a signal from the Microswitch is sent to the Drop Box. The signal causes a coil to momentarily produce a magnetic field that cancels out the field of the permanent magnet and as a result, drops the target.

- **Battery powered:**

The system is powered by a 9 volt battery, so it can be set up anywhere.

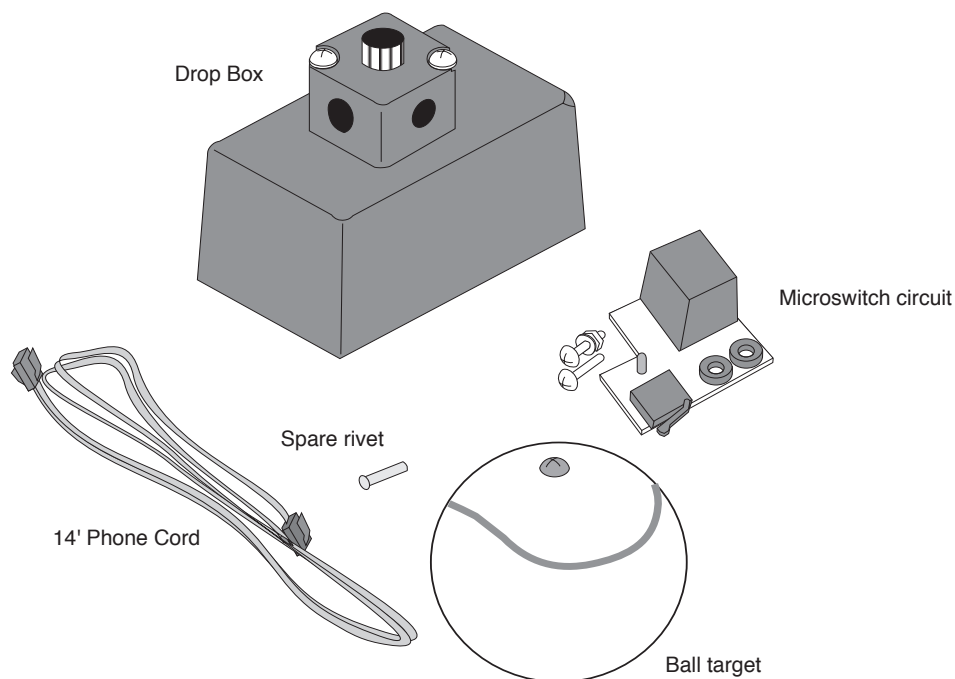
- **Target:**

The supplied target is a tennis ball, modified to attach magnetically to the drop box. Almost any object which has a piece of iron that will be attracted to the magnet can be used as a target. If you choose to use a target of your own making, put the smallest amount of iron in it that will stick to the magnet without falling. Too much iron will take too long to demagnetize, and the target will be dropped too late. A spare rivet is included to use with your own target.

- **Long or short range:**

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

## Equipment

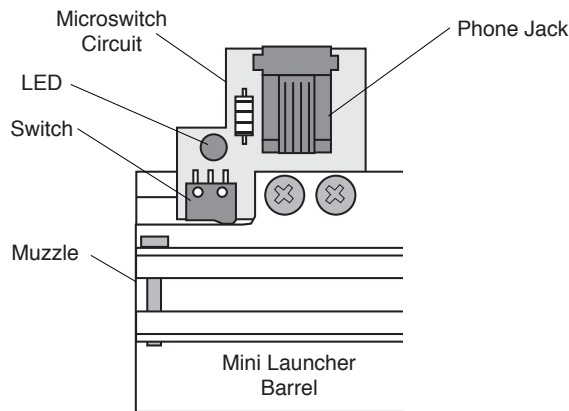


# How It Works

The Shoot the Target Accessory II consists of two main parts: the Microswitch Circuit and the Drop Box

## Microswitch Circuit

The circuit board contains a microswitch that controls the release of the magnetic target. It mounts directly to the launcher barrel. The Microswitch Circuit connects to the Drop Box with a phone cord. The piston in the launcher triggers the switch which sends the signal to the Drop Box to drop the target. An LED will light up when the circuit is active.



► **NOTE:** The circuit is active only when the phone cord connects both units **and** the piston is cocked.

## Drop Box

The Drop Box which holds the ball target hangs suspended from a lab stand. Inside the box, a Neodymium magnet is attached to a coil wrapped iron core. The steel screw in the ball target is attracted to the end of the core that protrudes from the box. A 9 Volt battery charges the capacitor inside the Drop Box. When the signal from the microswitch is received, the capacitor in the Drop Box discharges 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.

### Other equipment included:

- 14' phone cord with modular connectors (each end)
- Ball Target
- Spare 1/8" Diameter Rivet (to make your own target)

### Additional equipment required:

- Mini Launcher, ME-6825
- C-clamp or ME-9376B Universal Table Clamp to secure Mini Launcher to table
- Lab Stand
- Right angle clamp
- Rod to attach Drop Box

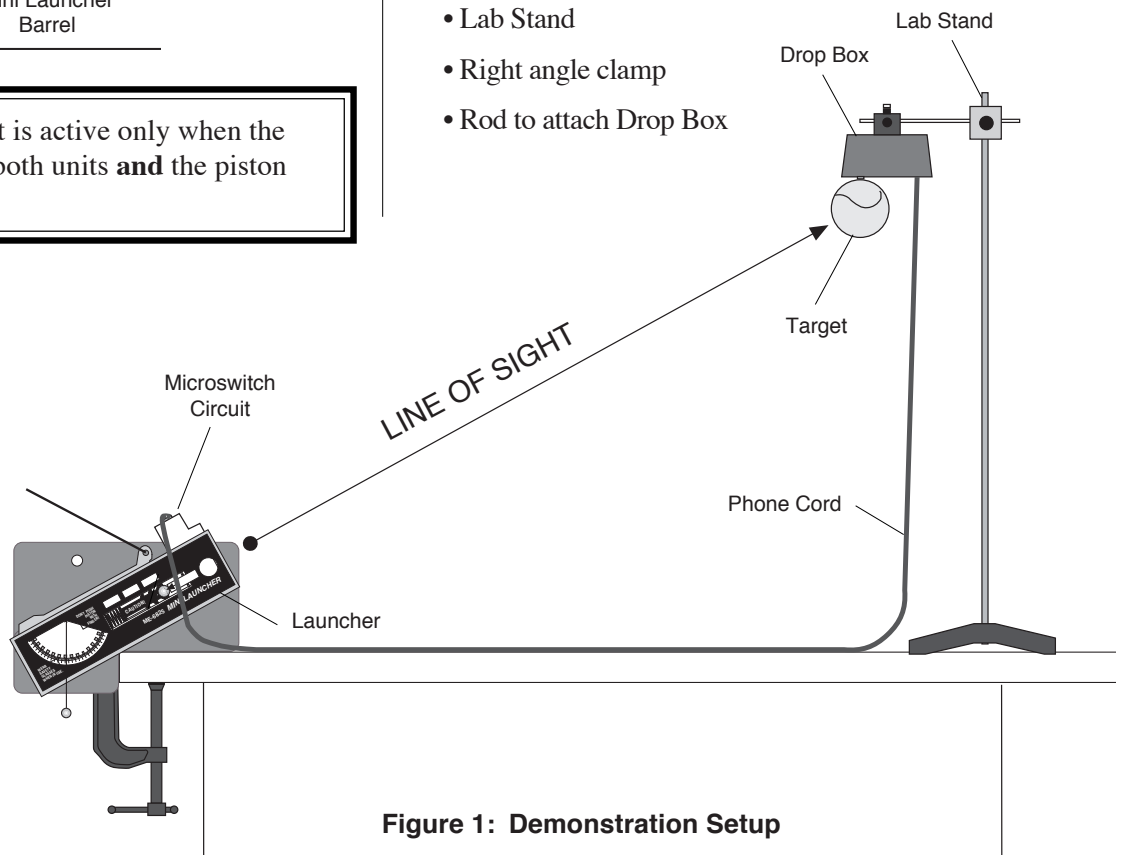
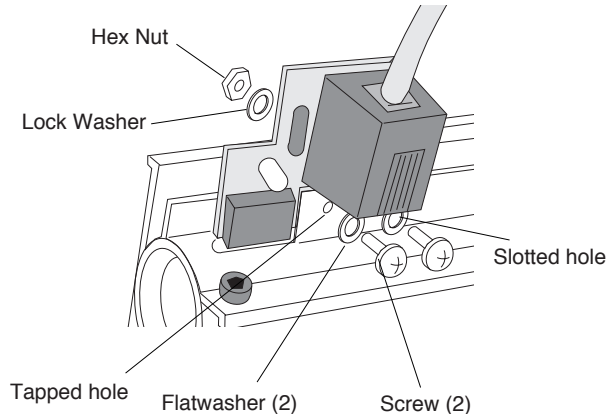


Figure 1: Demonstration Setup

## Setup

### Mounting the Microswitch Circuit:

- ① Remove the hardware from the circuit board.
- ② Slide the circuit board into the trigger channel on the top of the barrel. When aligning the washers on the board with the holes in the barrel, the microswitch will drop into the provided slot.
- ③ Place a flat washer over one of the screws and screw it into the tapped hole (the hole closest to the muzzle) until the screw is seated without completely tightening the screw.
- ④ Place a flat washer over the second screw and slide the screw through the slotted hole in launcher. Place a lockwasher over the screw and attach the hex nut using needle nose pliers or equivalent. Seat but do not tighten the screw.
- ⑤ Connect the phone cord to the phone jacks on the circuit board and the drop box.



- ⑥ Slightly depress the piston in the barrel. You will hear a clicking sound as the piston slides past the switch. The LED on the microcircuit will light up to indicate that the circuit is active.

► **NOTE:** The switch is properly aligned if the LED on the circuit board lights up **ONLY** when the piston is cocked.

If the LED does not light up when the piston is cocked the switch is misaligned. Pivot the circuit board toward the muzzle and slightly depress the piston until the LED lights at the correct setting.

- ⑦ Tighten both screws to secure the circuit board firmly.

### Mounting the Drop Box:

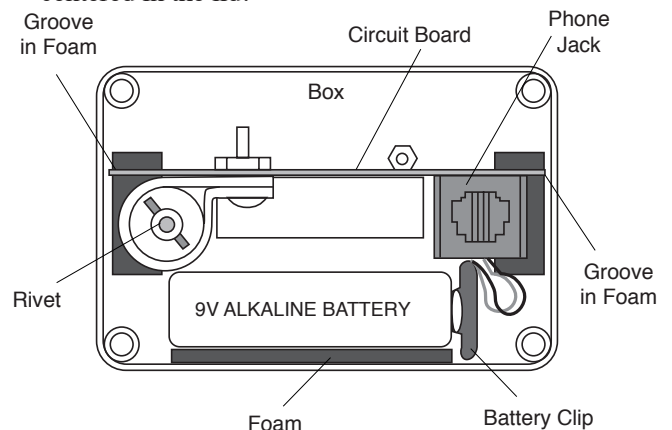
Clamp the rod clamp to a standard 1/2" rod.

### Replacing the Battery

► **NOTE:** Do not leave the phone cord attached to both parts of the unit while the piston is cocked. This will leave the circuit active and drain the battery.

When the LED lights only dimly, or stops working altogether, it is advisable to replace the battery inside the Drop Box.

- ① Remove the four screws from the box and carefully take off the lid.
- ② To pull the battery from the box you will most likely have to slide out the entire circuit board assembly. Remove battery from battery clip.
- ③ Attach a 9V Alkaline replacement battery to the battery clip.
- ④ Replace the circuit board in the box. Use the grooves which formed in the foam rubber as guides. See the following illustration for correct parts orientation.
- ⑤ Replace the battery in its slot close to the foam on the side of the box. Make sure the battery clip wires do not interfere with the assembly.
- ⑥ Replace the cover and screws. You may have to re-align the circuit board in the box so the phone jack is properly seated and the rivet protrudes approximately centered in the lid.



## Experiment: Shoot the Target

### Theory

The ball will hit a 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

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

$$\text{Ball: } y = v_0 \sin \theta t - (1/2)gt^2$$

Setting the two equations equal to each other gives  $h = v_0 \sin \theta t$ . Solving for the time gives  $t = h/(v_0 \sin \theta)$ . Substituting this time into the equation for the horizontal distance traveled by the ball  $x = v_0 \cos \theta t$ , gives  $x = h/\tan \theta$ . Solving for the angle shows that the Launcher must be aimed directly at the hanging target:  $\tan \theta = h/x$ .

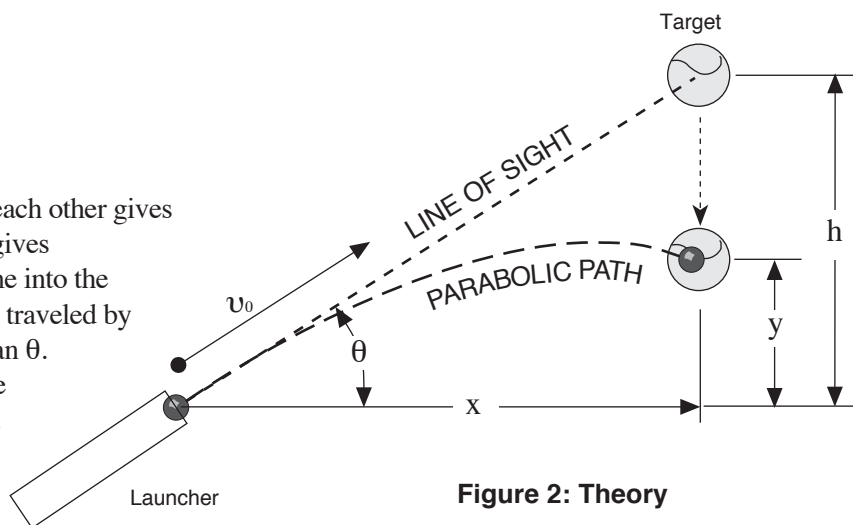


Figure 2: Theory

### Setup

- ① Clamp the Mini Launcher to a sturdy table.
- ② Attach the Microswitch Circuit to the launcher barrel.
- ③ Test fire the Launcher to see approximately how far away to mount the Drop Box.
- ④ Mount the Drop Box with the exposed rivet and phone plug facing down.
- ⑤ Connect the drop box to the switch on the launcher by plugging in the provided phone cord.
- ⑥ Hang the ball target from the Drop Box magnetic mount.

► **NOTE:** The launcher piston can be cocked either before or after hanging the ball.

### Procedure

- ① Aim the Launcher at the center of the hanging target ball.
- ② To load the Launcher put the ball in the piston and cock the Launcher.
- ③ The LED should be on, indicating that the target ball will be dropped when the launcher is fired.
- ④ Shoot the ball. It will hit the falling target ball.

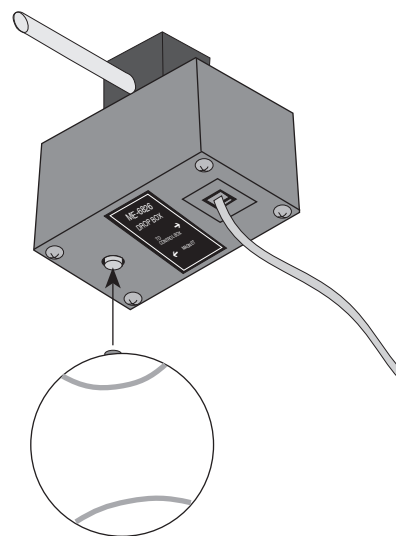


Figure 3: Attaching Target to Drop Box



# 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 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.

email: techsupp@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 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.

