

# **Academy Pendulums Mark 2 Foucault Pendulum Installation Manual**



**Academy Pendulums LLC  
<[www.academypendulums.com](http://www.academypendulums.com)>**

# Mark 2 Foucault Pendulum Installation Manual

## Preface

The Mark 2 Foucault pendulum kit operates by using a small amount of electrical power. It is important for the photo beam adjustments to be made accurately for power to be applied equally in all directions to the armature. Two pairs of photo beams trigger the magnet's power as the cable swings through the center. Pay close attention to the photo beams alignment. This adjustment can effect the Ball's precession around the pit. It may require a couple of days to determine if precession is operating properly.

Precession is a function of the Earth's rotation. Depending upon the Latitude of your pendulum, the time required to make one trip around the pit will vary. At the North pole it will make one revolution every 24HRS, while at Florida's latitude it may take up to 48HRS.

The height of the pendulum will determine the time of each swing. Therefore a "Time-on control" in the control panel will need to be adjusted to accommodate the length of time the magnet stays on during each swing.

Too much time on may cause excessive cable wobble. Too little time on may reduce the swing or cause the pendulum to cease operating.

For adjusting purposes a tone device on the control panel can be activated signaling when the power is 'on' to the magnet while you sight the Ball.

Power to the magnet is controlled via the "Amplitude control". This control drives the pendulum's swing distance. Too much power and the pendulum will be driven past the designed swing distance. Too little power and it will not reach that distance, and may in fact cause the pendulum to start swinging in an oval or figure eight. If this happens it will stop running after some period of time due to erratic triggering of the photo beams.

It is Important to note; when the pendulum is swing the proper distance, the O'rings on the armature should make a firm contact with the magnet.

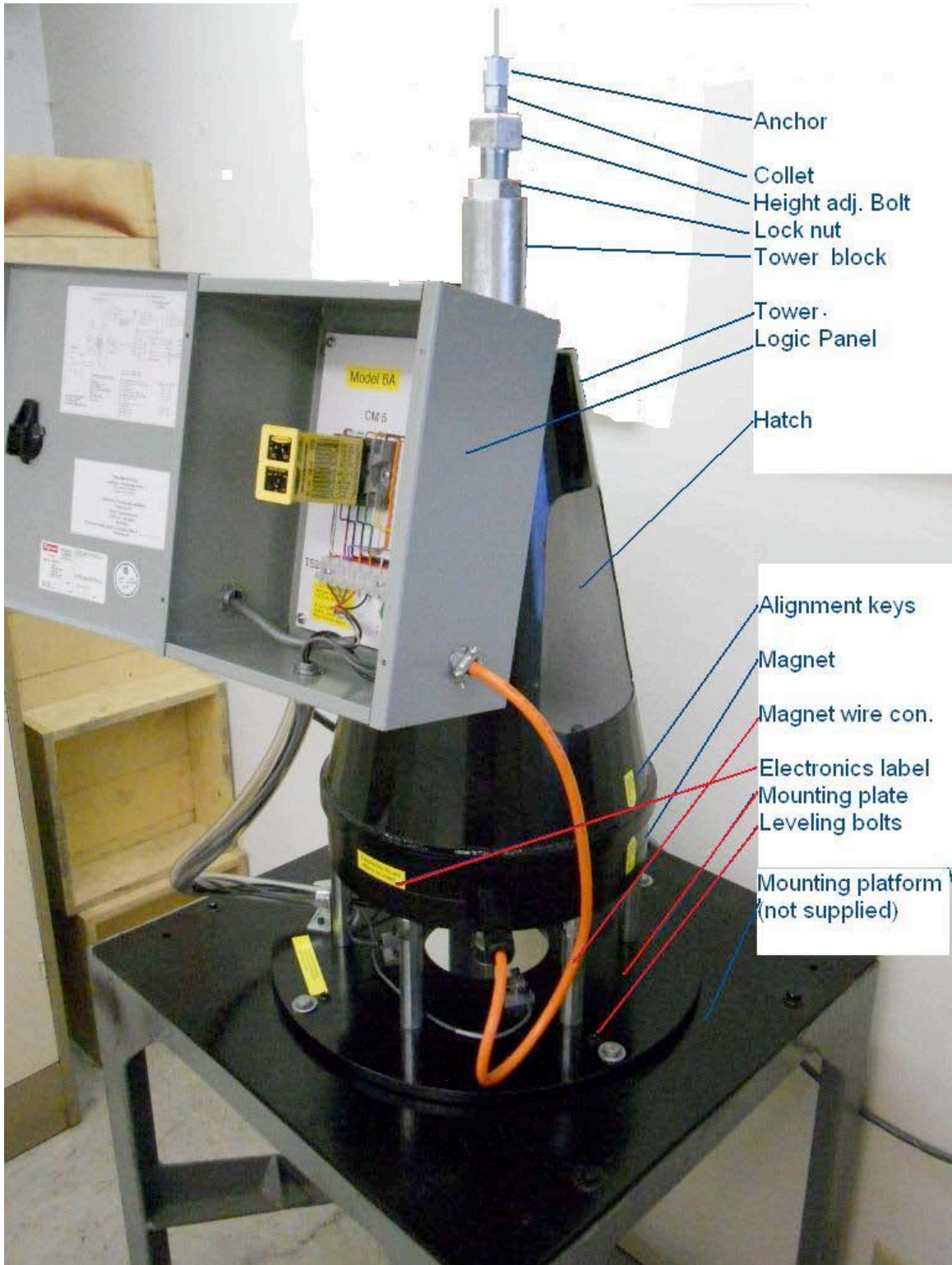
Depending on the architectural design, some mounting platforms for the pendulum may easily be accessed via catwalks etc, while others may require scaffolding or lifts to gain access. If your pendulums installation requires scaffolds or lifts, you will want to make sure everything is working correctly before eliminating access to the tower. Be sure to check the cable sleeve for slippage by pulling downward on it. Tighten the collets is necessary to stop any slippage.

# Index

## Page

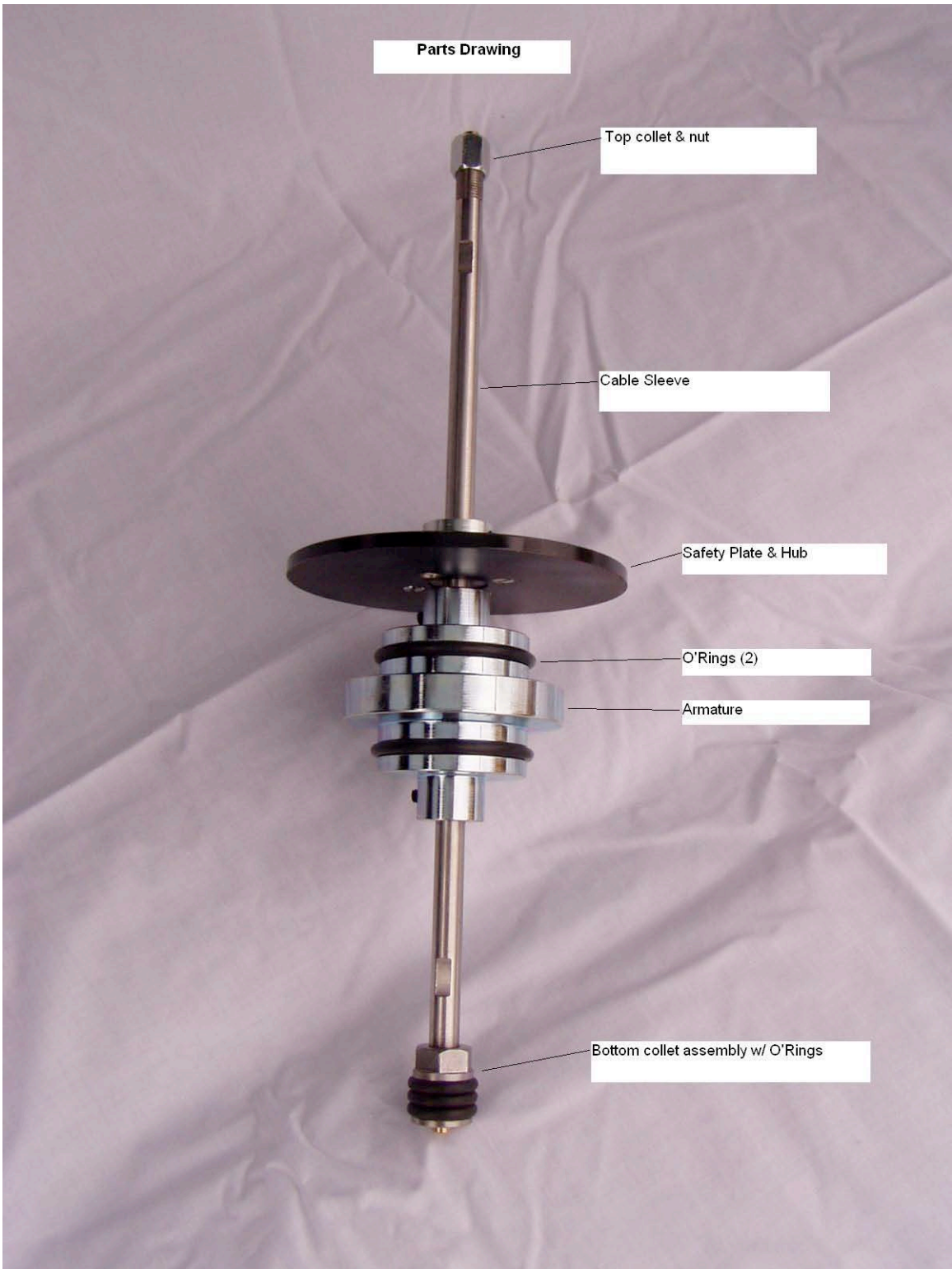
- 3 Tower parts diagram
- 4 Armature parts diagram
- 5 Installing the magnet assy.  
Leveling the magnet assy.  
Installing the tower assy.
- 6 Installing the cable and armature assy.
- 7 Installing the ball and end caps.
- 8 Ball installation continued.  
Hanging the ball
- 9 Adjusting the armature
- 10 Centering the cable
- 11 Installing the Logic panel
- 11 Installing the control panel and board
- 12 Setting the controls
- 13 Finishing the installation
- 13 Trouble shooting.

## *Installers notes*



## Tower Parts Drawing





**Armature Parts Drawing**

# Assembling the Mark 2 Foucault Pendulum Kit

1, Open the 3 smallest crates, and remove the contents.

## 2, **Installing the magnet assembly (magnet):**

Determine the best location for wiring and servicing of the logic panel.

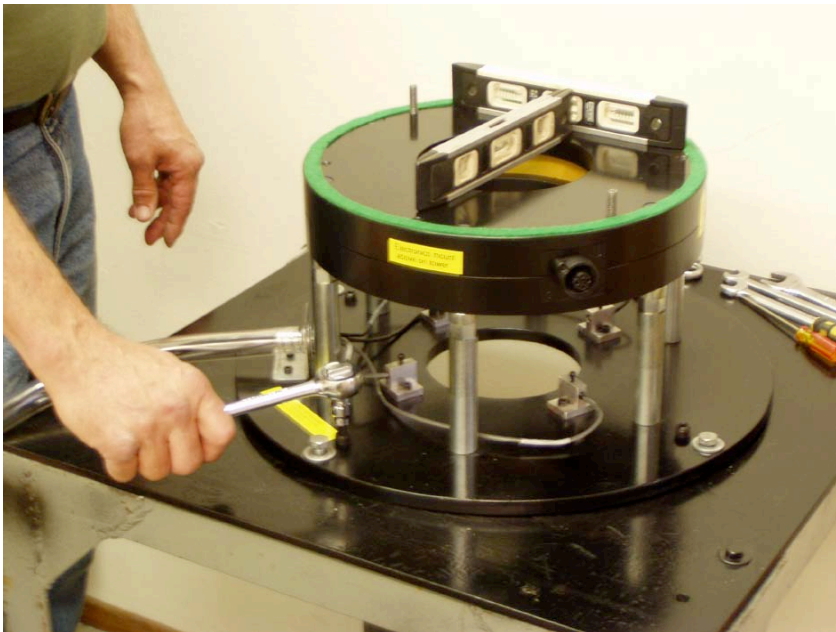
Place the magnet on the mounting platform.

Find the yellow label on the side of the magnet, which says “logic-panel mounts above”. Place the magnet with that label in the best location for accessibility to the “logic panel” for wire connections, and servicing.

Rotate the magnet until the 4 large holes in the mounting plate align with the nearest threaded holes in the mounting platform. Use the four ½” bolts, thick washers, and lock washers provide to screw the magnet to the platform, but do not tighten them at this time.

## **Leveling the magnet.**

Using levels on the top of the magnet, adjust the leveling screws (located in front of the mounting bolts) until the magnet is level in all directions. Make sure when tightening the hold down bolts the magnet remains level.



Shown; leveling the magnet (note the label on the magnet for electronics mount above.)

**3, Installing the tower assembly (tower):** (see picture next page)  
Install two 5/16" studs provided, in two of the threaded holes on the top of the magnet as guide pins (shown above). Place the tower onto the magnet **(observing the alignment markers at the bottom edge of the tower and the side of the magnet as seen below)** When these markers are aligned the Logic-panel mount should be correctly orientated. Remove the guide studs and install the six 5/16" bolts and lock washers and tighten the bolts.



Installing the tower. (NOTE; the yellow alignment markers)

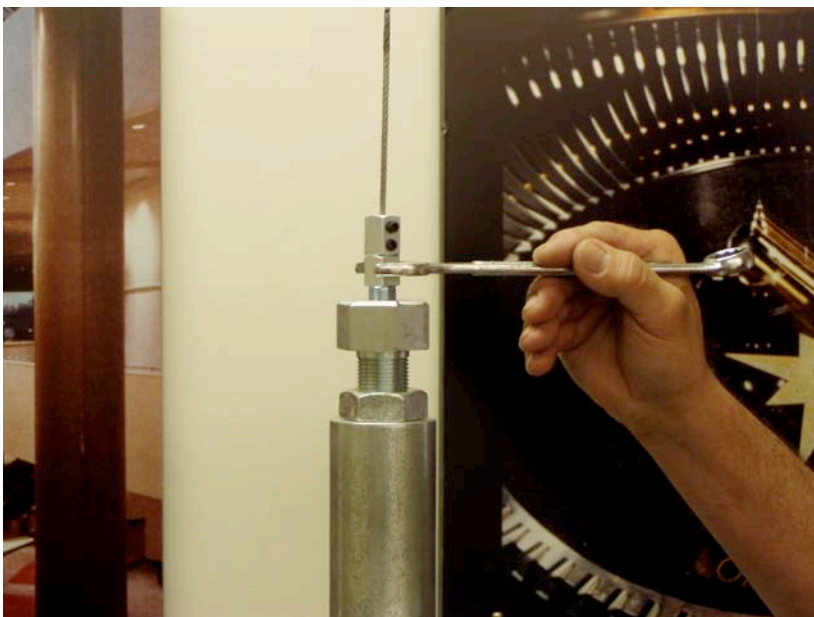
**4, Installing the cable sleeve and armature assembly (armature):**  
The armature has been pre-adjusted on the cable sleeve. Remove the top collet-nut assembly. Insert the cable up through the lower collet and cable sleeve until approximately 16" sticks out of the top of the cable sleeve. Install the top collet-nut assy. Hand tighten both the top and bottom collet nuts at this time. Tug on the cable to ensure the cable is held by the collets.



Pass the long end of the cable through the opening in the tower, and lower it down through the bore of the magnet. Make sure it does not tangle or wrap around any parts. Let it hang to the floor.

Next, work the armature and cable sleeve through the towers opening and down through the magnet, letting the safety plate sit on top of the magnet holding the cable sleeve and cable in place.

Remove the top tower collet (see picture below), and run the short end of the cable up through the pivot and out through the height-adjusting bolt. Push the cable through the collet and screw the collet onto the height-adjusting bolt. Pull the cable up just far enough to install one cable anchor on the end of the cable and tighten the 2 set screws. Tighten the collet. Once the cable is secured at the top of the tower, loosen the cable sleeve collets allowing the safety plate to remain resting on top of the magnet.





Tightening the top collet.

**5, Installing the Ball and end caps:** Open crate #4. The Ball is made of brass. Avoid contact with greasy hands, as this can make stains on the ball.

You can use the magnesium wheel cleaner supplied to polish the ball upon completion of the installation.

Move the heavy ball crate to the pit area and open the crate.

Remove the two end caps from their holder. Lift out the cap holder and place it aside. Two strong people can lift the 180 lb Ball out of its crate.

Lift the Ball and ball carrier out and set them on the floor.

Retrieve the ball installation tool from crate #2. For the next step you will need a soft pad. A moving quilts or a pile of rags will work well. Place the ball carrier next to the pad. Lift one side of the ball carrier until you can gently balance the ball standing on its threaded end on the pad so as not to damage the threaded end of the Ball. Set the ball carrier to one side.



**Moving the Ball from the ball carrier to the ball installation tool.**



Fold the legs under of the installation tool, and slide it under the Ball as far as you can (shown top right). Tip the Ball toward the tool until it rests on the felt ring. Raise the low end until the legs can be folded out. With the Ball resting on all four legs of the installation tool, Rotate the Ball so one threaded end is upward. Set the Ball and tool in the center of the pit. Holding the top ball cap in one hand, insert the cable through the caps pointed end and then push the cable down through the Ball. Gently screw the top cap onto the Ball and tighten snug only. Install a cable anchor approximately one inch above the welded end of the cable, and tighten the two ¼” set screws securely. Pull any slack up through the top of the Ball, and Install the bottom end cap.

#### **6, Hanging the Ball, and Allowing for initial cable stretch.**

If your pendulum is over 50 FT. high, Start by adjusting the height adjusting bolt (the large bolt on the top of the tower) downward so you have more upward adjustment for the ball. If your pendulum is less that 25FT. Set the height adjustment bolt slightly high to give you more downward travel. On tall pendulums over 70FT. you may need to raise the installation tool by putting 2x4 blocks under the feet to raise the installation tool before hanging the Ball. This will compensate for the cable stretch.

**Caution! To avoid dropping the cable, never allow the top collet, and the top anchor to be loose at the same time.** If both are loosened at the same time, the cable could slide through the tower and cable sleeve falling to floor.

Loosen the top collet on the top of the tower. Pull on the anchor or the cable until the cable is tight against the ball. Tighten the collet to secure the cable. Check the cable by tugging on it to make sure it will not slip. Loosen the

cable anchor and slide it down on top of the collet and re-tighten the two 1/4" set screws.

Return to the Ball and lift the end of the installation tool that will allow the legs to fold under. Lower the tool slowly making sure the Ball starts to hang, and the cable is holding fast.

Once the ball is clear of the tool it will begin to spin as the cable unwinds to reach a neutral balance. Allow the ball to spin, but keep it under control stopping it once in while to keep it from unwinding the cable too far.

As the cable unwinds the Ball will be lowered. Adjust to the proper floor clearance of 1" if not specified elsewhere by either turning the height-adjusting bolt at the top of the tower, or by the adjustable brass pin at the bottom tip of the Ball. The 3" long pin is held by a 1/4" set screw near the tip of the ball.

**7, Adjusting the armature and cable sleeve assembly:** With the Ball at rest, adjust the cable sleeve and armature height. With the collets loose at the end of the cable sleeve, move the cable sleeve up until the armature centers in the magnet. Tighten the cable sleeve collets nuts. Pull down on the cable sleeve to ensure it will not slip on the cable. Fine tune the armatures height positioning by using the height-adjusting bolt to raise or lower the cable and armature. The armature is correctly adjusted when the bottom of the armature is even with the bottom of the magnet when the armature is pulled to one side.



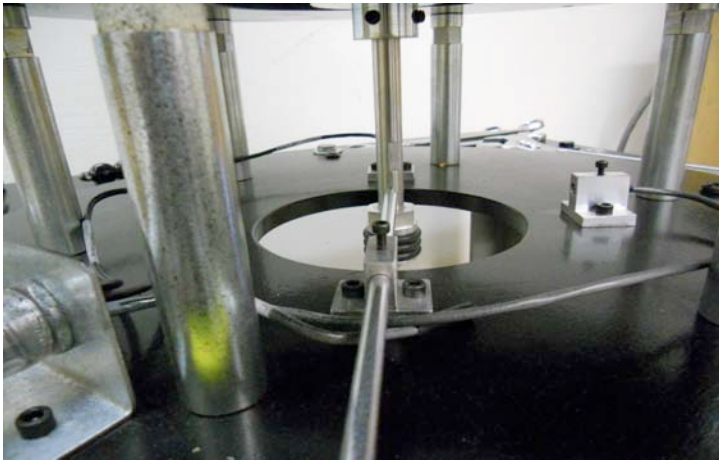
Shown above, the armature in proper adjustment.

**8, Centering the cable sleeve and armature in the magnet bore:**  
**Note: photo beam holders have been pre-adjusted and should not be moved.**

The following adjustment must be made with the Ball stationary in the middle of the pit.

Loosen the top screw holding a photo beams in its hold. Remove a photo beam and insert the 1/4" alignment rod through the holder. Slide it in until it's close to the cable sleeve. **DO NOT move the photo beam holder for centering.** Use the leveling bolts on the mounting plate to center the cable sleeve to the rod. Install a second rod at 90 degrees. Both rods must point to the center of the sleeve. If they are off center it may cause either erratic precession of the pendulums travel around the pit, or the pendulum

may lock into one area and not travel around the pit. Photo shows an alignment rod centered on cable sleeve.



**9, Optional; Check the armature for centering;**

Using the supplied gauge place it on the top of the magnet and sweep toward the armature. The distance should be the same in all directions.



Shown, gauging distance from magnet to armature.

**10, Installing the Logic panel:**



Unless otherwise stated in the architectural plans, the logic panel box should be mounted onto the tower. Occasional remote mounting may be required for accessibility.

Mount the Logic-panel box onto the mounting bracket on the tower using the two ¼” oval head screws, lock washers and nuts provided. Fasten the bottom of the box to the isolation mount using the ¼” nut and lock washer provided.

Connect the photo beam wiring to numbers 6 to 10 on the terminal strip.

Observe the colors of the wires pre-attached to the opposite side of the strip.

Install the cable clamp fitting on the right side of the box. Run the magnet cord through the clamp and connect the magnet cable to numbers 11 and 12. Connect the wiring from the control panel to terminals numbers 1 through 5 with the shielded cable connecting to numbers 4 and 5.

### **11, Installing the control panel and board:**

The control panel should be mounted in a place where a tone may be heard (when turned on) while you can see the pendulum swinging.

The control panel box is offered early for electrical rough-in. If your unit has been built in the wiring should be pre-installed as well.

If the control panel comes with the pendulum kit you will need to fasten the panel box to a wall, and run conduits and wires as required in the architectural specifications. Specifications may be found at

[www.academyPendulums.com](http://www.academyPendulums.com) click on Mark 2 architectural specifications)

Wiring from the control panel to the logic panel should correspond. Connect the terminal strip terminal numbers 1 through 5. The shielded cable connects on terminals numbers 4 and 5.

120VAC can be hooked up as indicated within the control panel box. The control panel is connected to the panel box via a plug-in cable.

### **12, Setting the controls:**

There are two controls that must be adjusted to accommodate the length and swing distance. The time control adjusts the magnet on time, and the amplitude controls the power to the magnet.

There are three switches at the bottom of the control panel for Power, Tone, and Ammeters. The tone and ammeter will indicate when the magnet is in the power on state. The ammeter will show how much power the magnet is drawing.

Begin by turn the Time and Amplitude controls to approximately  $\frac{1}{4}$  of the way on. Turn the three switches on at the bottom. (If the tone control is too loud place a piece of masking tape over the horn.)

Pull the pendulum to one side of the pit. Hold it until it is stable and slowly release it. Each time the pendulum crosses the center of the pit the magnet should turn on. The tone will sound when the switch is on and the magnet is being powered

### **Adjusting the time control**

Adjust this control to turn the magnet off after the pendulum has reached the maximum swing and started back. Fine tune this control to obtain the smoothest cable operation while watching the top of the cable. There will be some cable wobble near the top, but adjust for the least amount of wobble.

### **Adjusting the Amplitude control**

You will need to know how far the pendulum should swing. Check the architects plans for this dimension.

With the meter switch on, and the magnet in power on cycle, set the meter to approximately 300ma. Adjust the Amplitude control until the proper swing distance is acquired. **Note:** the pendulum must swing far enough for the O'Rings on the armature and bottom cable sleeve collet to make a firm contacts with the magnet.

Allow adequate time between amplitude adjustments as the pendulum will be slow to react. If there is **not** enough power the ball may decrease it's swing and may eventually begin to swing in an oval pattern, or just quit swinging.

Too much power could swing the pendulum too far causing a possibly collision with any near by objects.

It could take a day or two to determine if the pendulum is operating properly at all points around the pit.

The speed at which the pendulum will progress around the pit depends on the latitude of the installation.

At the North pole, it will progress 360 degrees every 24HRS. At the Equator there will be no Progression. While in Mexico Cities 30 degree latitude the pendulum will only travel 180 degrees in 24HRS.

## **13, Finalizing the installation:**

Use the automotive magnesium wheel polish and diaper supplied with the kit to polish the Ball.

Mount the educational plaque if required, if not deliver it to the owners

If everything is working properly all that should be left to do is

Make sure the safety plate is sitting just above the armature, and the screws are tight.

Install the tower hatch doors, and the draft shield around the magnet stand offs.

Be sure to give the owners and installation manuals to your supervisor or the building owners.

If additional manuals are needed they may be copied from the web at; [www.academypendulums.com](http://www.academypendulums.com) Be sure to copy the Mark 2 manuals needed.

### **Trouble shooting guide:**

Every pendulum has been factory tested and is in working condition prior to packing. However adjustments are required in the field to make your pendulum operate properly.

**Erratic triggering** can be caused by too much cable wobble, or photo beam sensitivity may need adjusting due to ambient light.

**Cable wobble:** can be adjusted by adjusting the time on, and amplitude controls in the control panel. (See; setting the controls on page 12.)

**Sensitivity control:** A sensitivity control is mounted on the top of the CM5 module located in the logic panel. This controls the photo beam sensitivity.

It uses a 40 turn pot to control the amount of power to the photo beams. It requires a very small screwdriver to adjust this control. Two lights are mounted onto the CM5. The left light indicated when the power is enough for the photo beams to react. The right light indicates by blinking when the beams are being triggered. Too much power and this light will just stay on.

### **Pendulum does not progress;**

Should you encounter a problem with the progression be sure to check both the armature adjustment and photo beam centering adjustments.

If a height adjustment is required, you can use the height adjustment bolt to raise or lower the armature. However, this will change the balls height as well. Make sure to check the centering of the armature after the height adjustment. (See page 10 for centering the cable sleeve adjustment)

### **Pendulum fails to operate in one or all quadrants;**

If your pendulum operates for several hours then slows and stops.

Or it fails to operate in a certain area of the pit.

Check for photo beam alignment.

Check to see if the photo beam at 90 degrees to the swing is operating.

(Cover one beam and intermittently cover the one at 90 degrees to see if the light on the CM5 logic module blinks)

Check the sensitivity control adjustment.

Check the armature adjustment.

**Loud clanking sound at the top;** Check the armature adjustment for height centering. Center the armature using loosening the cable sleeve collets and raising or lowering the armature. Tighten the collets and test the cable sleeve by pulling down on it

If proper operation is not obtained, please contact Academy Pendulum Sales.

No charge for consulting.

<[www.academypendulums.com](http://www.academypendulums.com)>

Install manual. 5/21/12