

2.0 Meter Air Track

SF-9214

Introduction

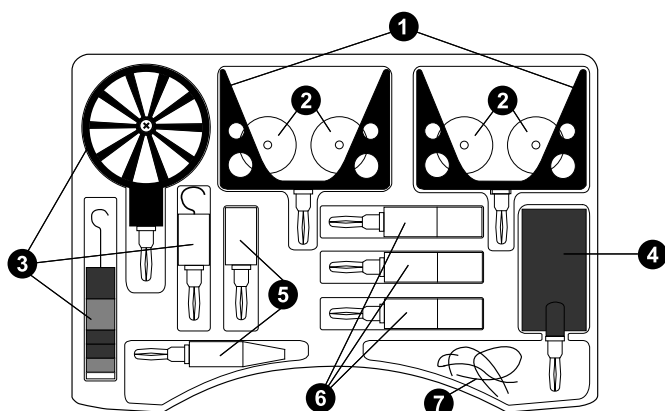
The PASCO Air Track is 2.0 meters long and has a guaranteed straightness to within 0.04 mm over its entire length. The track construction is a large square aluminum extrusion of 3 mm thick walls, which are further strengthened by a supporting U-channel. A single foot support at one end and a double foot at the other end allows for lengthwise and sideways leveling.

Equipment

Included equipment:

- 2 m Air Track
- 2× gliders
- 2× metal end plates
- 2× end stops
- 2× finger screws
- 4× hexagonal screws
- Single leg with adjustable foot
- Double leg with adjustable feet
- Accessory kit with storage case

Accessory kit:



- ❶ 3× glider bumpers
- ❷ 4× glider masses (50 g)
- ❸ Constant acceleration kit
 - Ball-bearing pulley
 - Glider hook
 - Mass hanger and masses
- ❹ 2× glider flags
- ❺ Inelastic collision kit
 - Cylinder with wax tube
 - Cylinder with needle

- ❻ 3× bumper plates
- ❼ 3× elastic bands for bumpers

Other required equipment:

- Variable Output Air Supply (SF-9216)

Equipment setup

Unpack the equipment

The 2 m Air Track is shipped in two containers: a large tube containing the track itself, and a cardboard box containing the various accessories. To unpack the air track:

1. Use a Phillips screwdriver to remove the screws from one end of the tube, then gently remove the plastic cap and the padding.
2. Carefully pull the track free from the tube.
3. The track comes pre-installed with plastic end plates. Using the small hex key included with the metal end plates, remove the screws from these plastic end plates, then remove the plates.
4. Install the metal end plates on each end of the track, securing them in place with the same screws used to secure the plastic end stops. Use the small hex key to tighten the screws.

❗ **IMPORTANT:** Do NOT allow the upper surfaces of the track, containing the air holes, to be scratched or nicked. Any protrusions on these surfaces may impede the glider's motion.

Assemble the air track

1. Examine the bottom of the Air Track and locate the nuts in the grooves. Move the nuts in the two *outermost* grooves toward the end stop with a hole for the hose.
2. Place the track upright on a table, with the end of the track from Step 1 protruding over the edge and the nuts in the grooves visible from below.
3. Place one of the hexagonal screws at the tip of the large hex key.
4. Align the holes in the large foot with the nuts in the outermost grooves, as shown in Figure 1. Insert the screw and hex key up through one of the holes in the large foot.

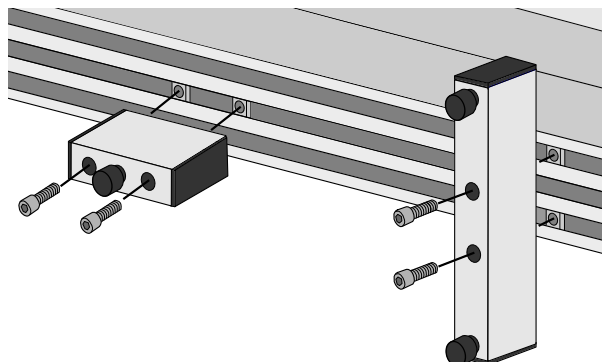


Figure 1: Align the feet with the Air Track and insert the hexagonal screws.

5. *Without letting go*, tighten the screw into the nut until it stays in place, but not so much that the foot can no longer be displaced.
6. Repeat Steps 3 through 5 with the other hole on the large foot to secure the foot to the track.
7. Rotate the track so that the other end of the track now protrudes over the edge of the table instead. Move the nuts in the *central* groove towards this end.
8. Align the small foot with the nuts in the central groove, then repeat Steps 3 through 6 with the small foot, securing it in place with the two remaining hexagonal screws. (See Figure 1.)
9. Insert one of the plastic end stops onto the tracks, directly adjacent to one of the metal end plates.
10. Secure the end stop in place using one of the finger screws, as shown in Figure 2.

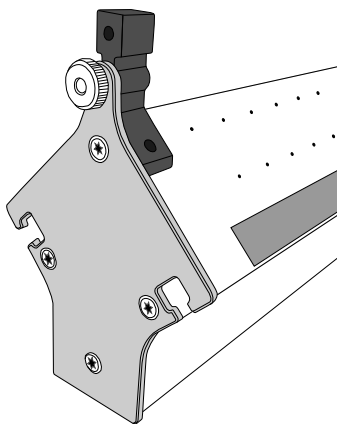


Figure 2. Securing the end stop to the end plate.

11. Repeat Steps 9 and 10 for the other end stop at the other end of the track.

Position the feet

When connected as described in **Assemble the air track**, the feet can be moved along the grooves to different positions as needed. During experiments, the feet should be placed where they optimally support the track, as even a slightly extruded aluminum profile is slightly elastic.

For a theoretical, perfectly straight 2 m track, model calculations suggest that the large foot should be positioned at the **43.5 cm** mark on the track, and that the small foot should be positioned at the **146.5 cm** mark. You can adjust the distance between the feet to counteract any slight curvature of the track.

Connect the track to the air supply

To connect the Air Track to the Variable Output Air Supply (SF-9216), insert the hose from the air supply into the large hole in one of the metal end plates. To perform experiments, place a glider onto the track and turn on the air supply. The output of the air supply should be adjusted so that the glider just barely floats on the track, as excessive air pressure may cause the glider to wander on the track, even without an accelerating force.

 **NOTE:** The Variable Output Air Supply will slightly heat the Air Track, causing it to expand. The beam under the track has been set so the track will remain straight to within ± 0.04 cm when warm, or after 5 minutes of operation with the air supply.

Level the air track

To level the Air Track, place the track on a stable, level table and adjust the leveling screws on the feet until the track is as level as possible. A bubble level may be used to determine whether or not the track is level.

However, when the track is in use with the glider, a more precise leveling is required. To perform the final leveling, follow these steps:

1. Connect the Air Track to the Variable Output Air Supply. Turn the air supply on.
2. Place a glider in the middle of the track with no initial velocity.
3. If the glider moves toward one end of the track, adjust the leveling screws to increase the height of that end and decrease the height of the other end.
4. Repeat Steps 2 and 3 until the glider remains at its initial position, not accelerating in either direction.

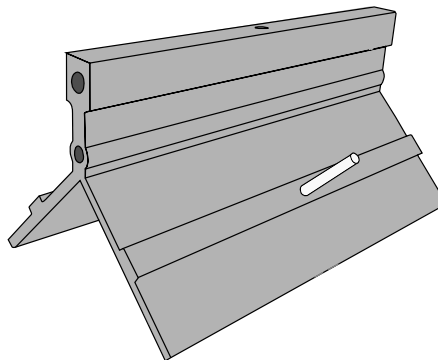
 **NOTE:** Even when the track is as level as possible, the glider may oscillate slightly about its position. This movement is caused by air currents from the air holes in the track and is considered normal.

Accessories

Glider

The black anodized aluminum glider has a mass of 180 ± 1 g and a length of 129 ± 1 mm. To increase the glider's mass, place the supplied 50 g masses on the steel pins protruding from each side of the glider.

 **NOTE:** Masses must *always* be added symmetrically, with the same number on each side, for the glider to function properly.



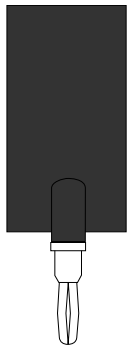
Glider accessories, such as the rubber band bumpers, can be mounted in one of the holes at each end of the glider. In most cases these accessories should be mounted in the lower hole, to prevent interference with any photogates being used. These accessories will increase the mass of the glider and must be taken into account in all calculations.

 **NOTE:** If an accessory such as a bumper plate is placed on one end of the glider, then an accessory of equal mass should be placed on the opposite end. This will keep the glider level on the Air Track and not cause it to propel itself in a particular direction.

All of the accessories in the following sections mount to the glider, or to the Air Track end stop, via standard 4 mm plugs. All of them except the pulley weigh approximately 10 g.

Flags

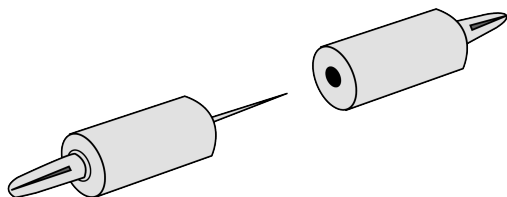
When using photogates to measure the velocity of the glider, insert the 25 mm flags into the hole on the top surface of each glider. This will cause the flags to interrupt the photogate beam as the glider travels.



The glider itself may also be used as a "flag" if a flag of different length is needed. To use the glider as a flag, cut a piece of thin cardboard or aluminum to the desired length and tape it to the top of the glider.

Wax tube and needle

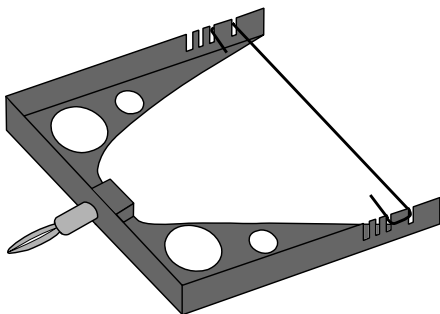
The wax tube and needle are designed to be used in inelastic collision experiments. The wax cylinder is mounted on one glider, while the needle is mounted on the other so that it faces toward the wax cylinder. If positioned properly, as shown below, the needle will become stuck in the wax tube when the gliders collide, causing the gliders to stick together. After a few collisions, the wax should be pressed into the tube to ensure it properly adheres to the needle.



 **NOTE:** The needle is covered by a small cork for safety. When storing the needle in the accessory tray, replace the cork on the needle.

Rubber band bumpers

These bumpers provide a soft collision, eliminating any vibration of the glider as it collides with another glider or an end stop. To assemble the bumper, stretch one of the provided rubber band strips across the gap between the forks and then secure the ends in an adjacent notch, as shown below.



When mounted on the end stops, these bumpers may also be used as glider launchers. To do this, pull the glider back until it touches the nut on the end of the bumper, as shown in Figure 3, then release the glider. You can change the impulse imparted to the glider by moving the rubber band to a different groove in the bumper.

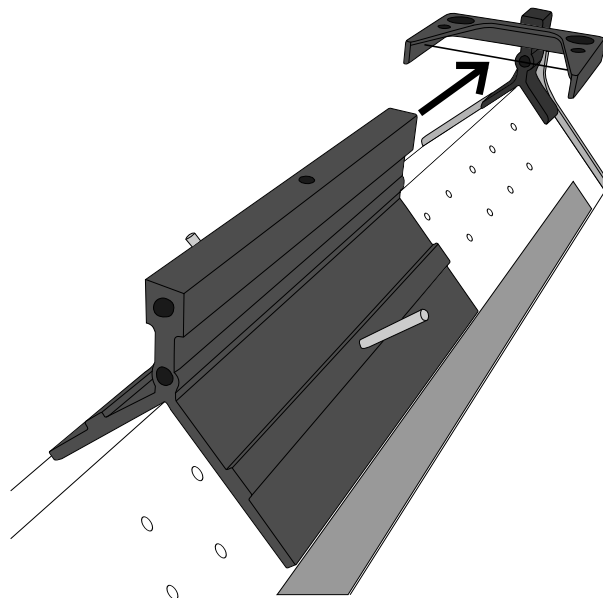
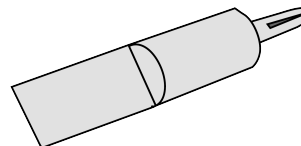


Figure 3. Using the rubber band bumper as a launcher.

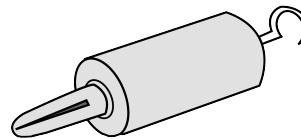
Bumper plates

These plates mount on the ends of the glider and are designed to collide with the rubber band bumper.

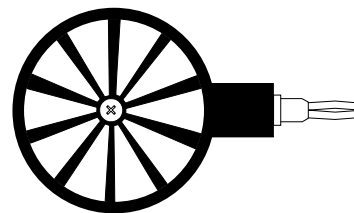


Hook

The hook is used to attach a string to the glider. It may be mounted to the end or top of the glider as needed.



Pulley



The pulley should be mounted in the bottom hole of the end stop opposite the air supply, facing away from the track. A string that is attached to the glider, hung over the pulley, and tied to a hanging mass on the other end can be used to accelerate the glider. (See Figure 4.)

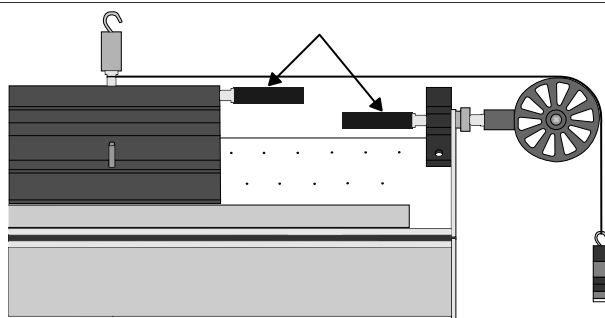
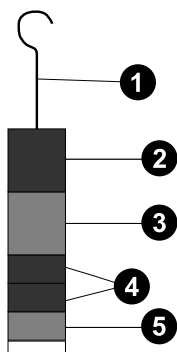


Figure 4. Accelerating the glider using a hanging mass and the pulley.

NOTE: To protect the glider, do NOT let it hit the end stop. Attach a rubber band bumper at either of the positions shown in the image above, but NOT both.

Mass and hanger set

The masses and hanger are intended for use with the pulley. A guide to the components of this set is shown below.



- ❶ Mass hanger (2 g)
- ❷ Plastic mass (2 g)
- ❸ Metal mass (10 g)
- ❹ 2× plastic mass (1 g)
- ❺ Metal mass (5 g)

Maintenance

Air Track

The only maintenance the Air Track requires is keeping its surface clean and free of scratches or nicks. When storing the unit, make sure nothing can damage the track's surface. If the track becomes nicked in such a way that a protrusion on the surface hinders the glider's motion, gently file or sand down the protrusion.

The Air Track is factory aligned to deviate less than ± 0.04 mm from linearity and is designed to remain within these specifications for many years. However, if exposed to excessive stress, it is possible the track may get out of alignment. This will cause the glider to exhibit an uneven velocity while traveling along the track, speeding up and slowing down as it traverses the slight curves in the track.

If uneven motion of the glider impedes the use of the product, the Air Track will need to be realigned. This requires a special test tool, so we recommend returning the unit to PASCO for adjustment in this circumstance.

Glider

Handle the gliders with care to maintain their friction-free motion on the Air Track. If any scratches or nicks occur on the surfaces which float on the track, remove them with a file or sandpaper.

If the glider is dropped or bent out of alignment, it must be straightened so its profile matches that of the Air Track. If the angle between the two sides of the glider is too small, the glider will stick to the track; if the angle is too large, the glider will wobble as it moves.

Rubber band bumper

The rubber bands may deteriorate with time and use. They may be replaced with any elastic band that produces the desired launch and "bounce" effects.

NOTE: To extend the life of the rubber bands, remove them from the bumpers when not in use. Keep in mind that excessive handling of the rubber bands may remove their protective powder coating.

Specifications and accessories

Visit the product page at [pasco.com/product/SF-9214](https://www.pasco.com/product/SF-9214) to view the specifications and explore accessories. You can also download experiment files and support documents from the product page.

Experiment files

Download one of several student-ready activities from the PASCO Experiment Library. Experiments include student handouts and teacher notes. Visit [pasco.com/freelabs/SF-9214](https://www.pasco.com/freelabs/SF-9214).

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Limited warranty

For a description of the product warranty, see the Warranty and Returns page at www.pasco.com/legal.

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