

CEENBot

Chassis Assembly

GENERAL: While operating, the CEENBot stepper motors will cause some vibration. The hardware must be securely tightened to prevent parts from vibrating loose and to ensure quiet operation.

Recommended tools are:

- #1 Phillips screwdriver for 4-40 screws.
- #2 Phillips screwdriver for 6-32 screws.
- ¼" socket or nut driver for the 4-40 nuts.
- 5/16" socket or nut driver for the 6-32 nuts.
- 11/32" socket or nut driver for the 8-32 nuts.
- ½" socket or nut driver for the wheel nuts.
- 7/16" socket or nut driver for the kingpin assembly.
- Pliers
- Ruler

Screw and Nut Descriptors

The screws and nuts are specified by their diameter, the number of threads per inch, and the length of the screw. The two diameters of screws and nuts are #4 and #6. The #4 is smaller than the #6. The #4 screws have 40 threads per inch and the #6 screws have 32 threads per inch. The designation 4-40 x ½" means a #4 screw with 40 threads per inch that is ½" long.

Most of the nuts used have a nylon insert which prevents them from loosening from vibrations. You will need a nut driver or pliers to hold the nut when tightening it. This type nut is called a **nylon lock nut** in this document.

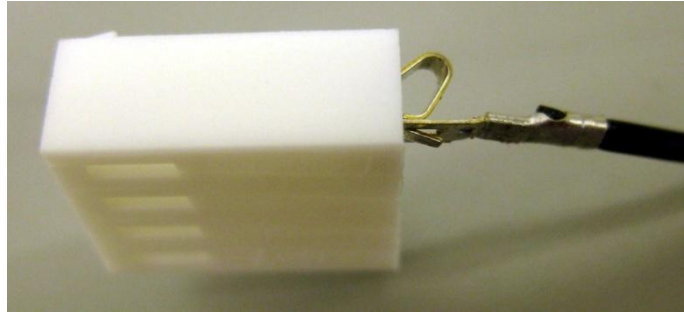
Standoff

A standoff is a spacer used to provide adequate space between circuit boards. A standoff is specified by its length and the type of threads it has. It could have tapped holes (female) on one or both ends or it could have male threads on one or both ends. Those with female threads on both ends are listed as Female – Female (F – F) and those with one female and one male end are listed as Female – Male (F – M)

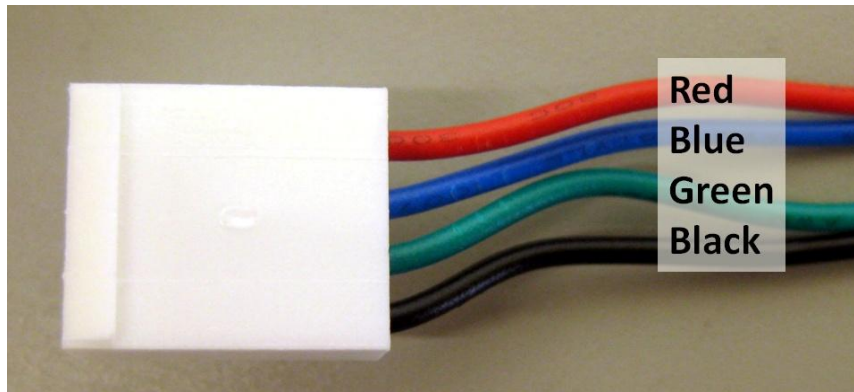
Motor Connectors

Crimp the connectors on the wires from the motor.

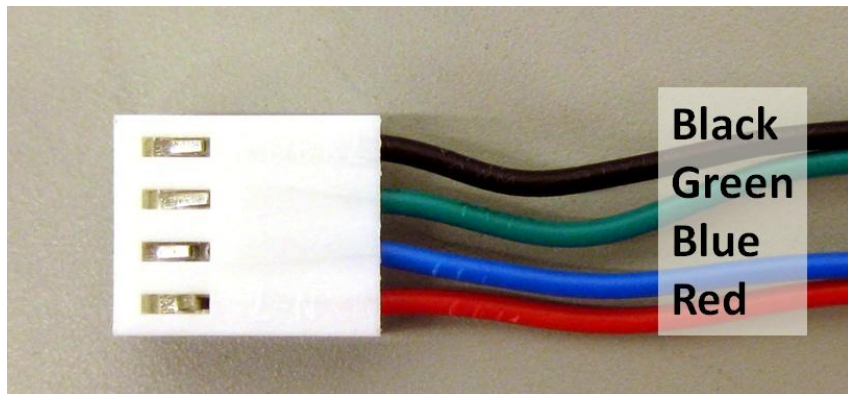
Attach the motor wires to the connector. The metal connectors are inserted into the white plastic housing. The loop on the connector goes on the opposite side of the housing as the small rectangular holes.



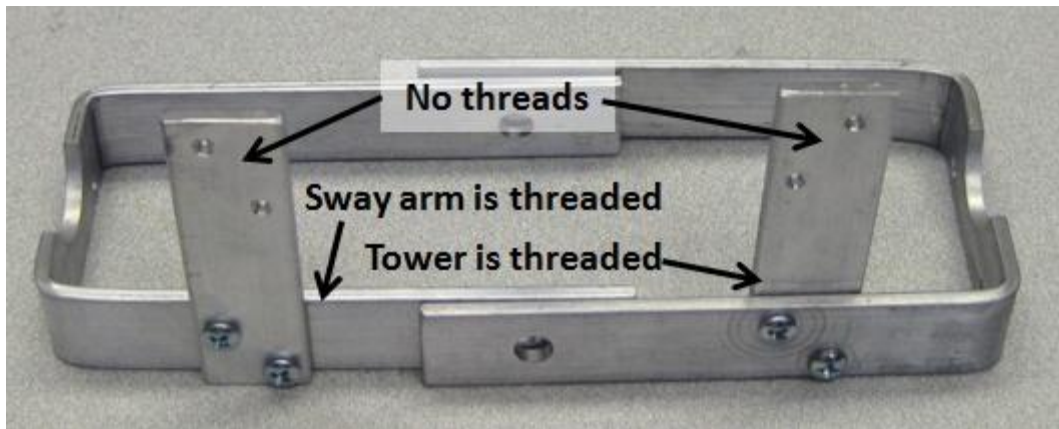
Looking at the solid side of the connector



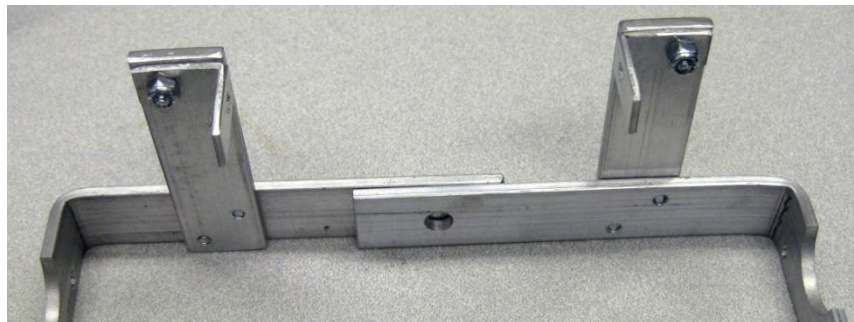
Looking at the side with holes



Shock Towers: Mount the shock towers to the sway bars as shown. The view is from the front of the CEENBot. The half-moon cut-outs of the sway bars are to the top. The right shock tower (on the left side of the photo) is mounted by screwing two 6x32x1/4" screws into the threaded sway bar. The left shock tower (on the right side of the photo) is placed on the inside of the sway bar and mounted by screwing the 6x32x1/4" screws into the threaded shock tower. **These parts will only go together one way.** They are not interchangeable left to right, top to bottom or front to back. Many people think they have defective or wrong parts when they really are putting them in the wrong place. Pay particular attention to the location of the holes and whether they are tapped (threaded) or just drilled.



Mount the 3/8" angle aluminum to the tops of the shock towers using 4x40x3/8" screws and nylon lock nuts.



Motor

Mount the motors to the sway arms using the 4-40 x 5/16" screws and split lock washers. The lock washers go between the screw head and the sway arm.

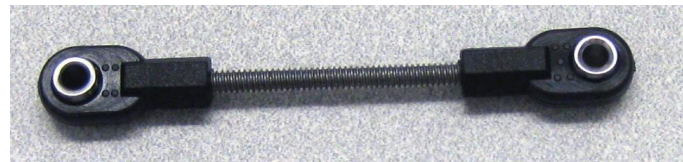


Stabilizers:

Press the Metal inserts into the end hole of the plastic ends. Use a nut driver over the plastic to apply even pressure on the plastic or use a pair of pliers to force the insert.



Thread the stabilizer bar ends onto the 4x40 allthread. Screw both ends until 1 1/8" allthread remains visible. You may need to cut about 1/4" from the allthread to get this distance. The lab instructor has a cutting tool to do this.

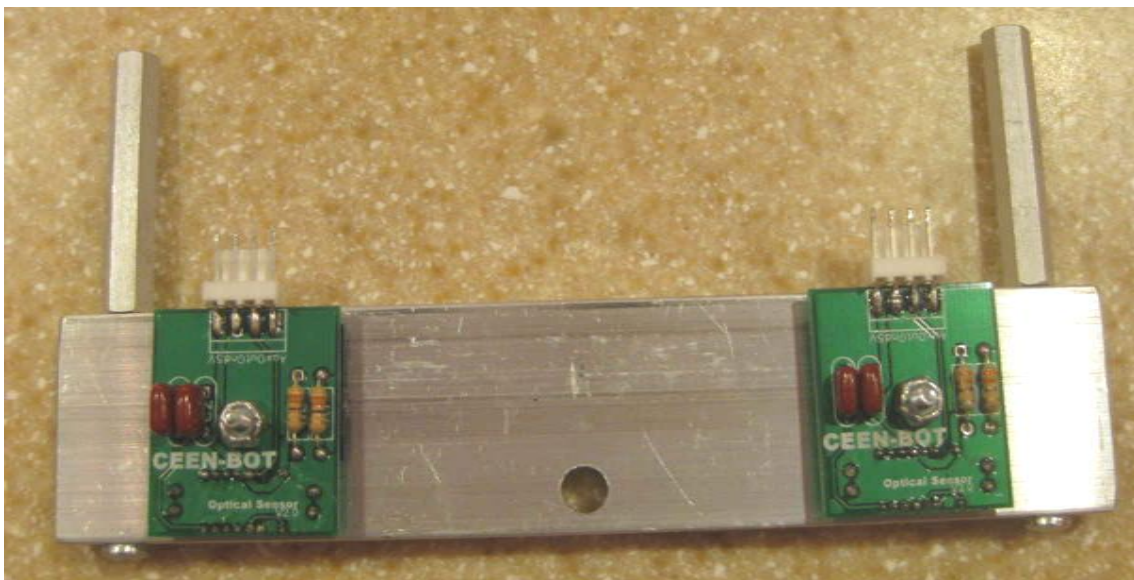


Bumper

Mount the 1 ½" F-F standoffs on the front bumper using 6-32x1 ¾" screws.



Mount the two Sensor boards on the bumper using the 4 – 40 x 5/8" screws and nylon lock nuts. Note that they are mounted on the back side (the side without the CEENBOT engraving) and the red LEDs are on the outside. **Put two fiber washers between the bumper and each board.** This prevents the board from touching the metal bumper and shorting out.

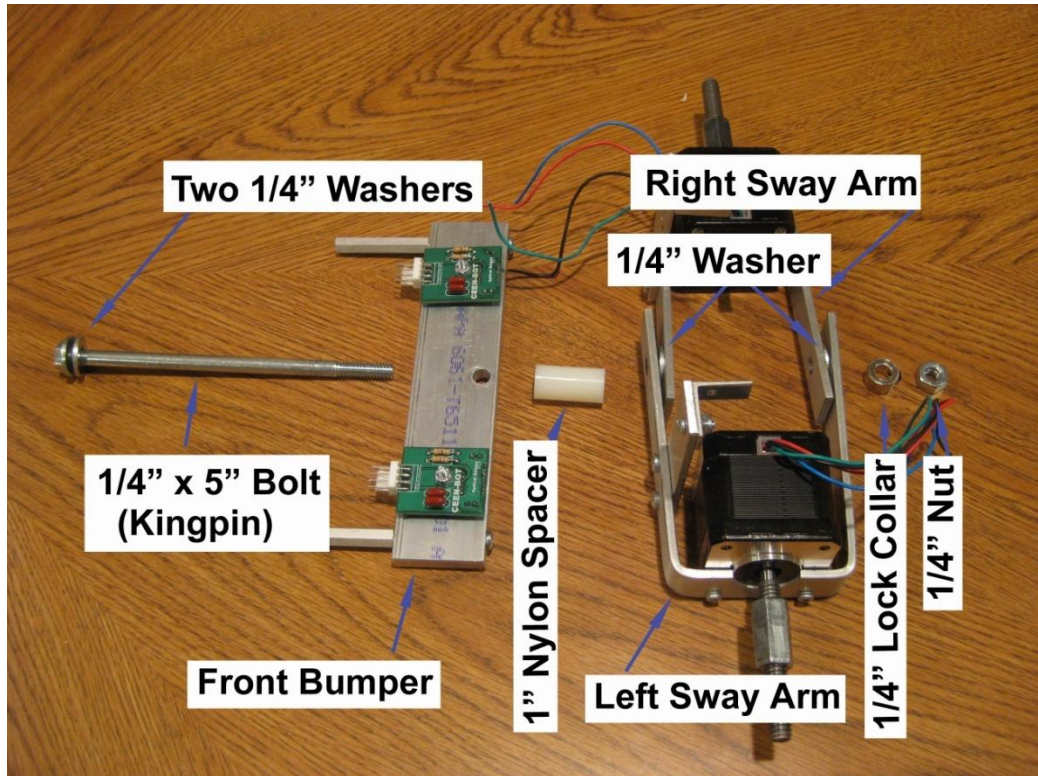


Kingpin Assembly:

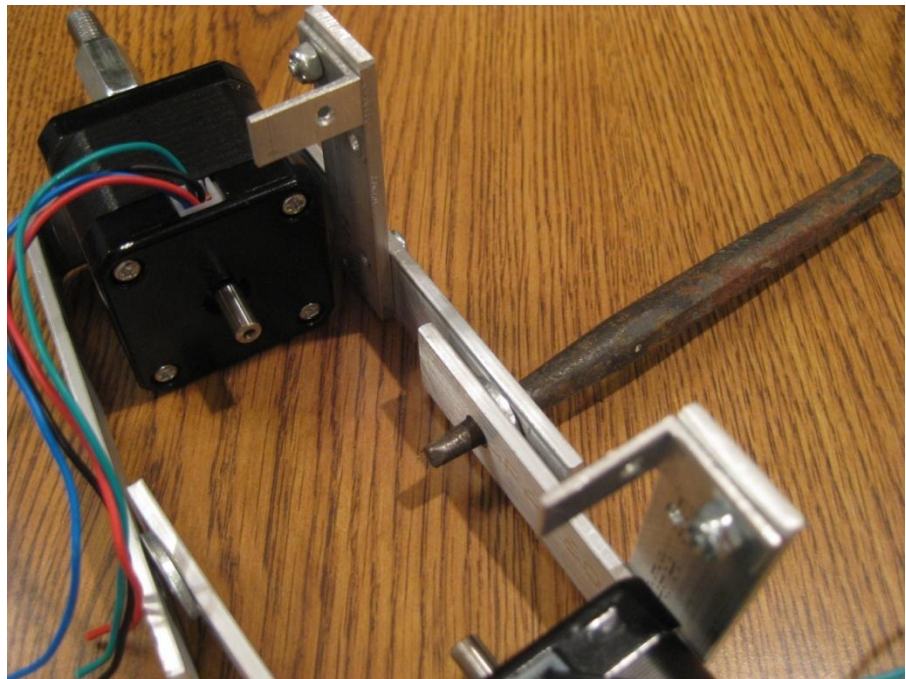
Assemble the parts for the Kingpin unit

Place two 1/4" flat washers on the bolt between the bolt head and the front bumper.

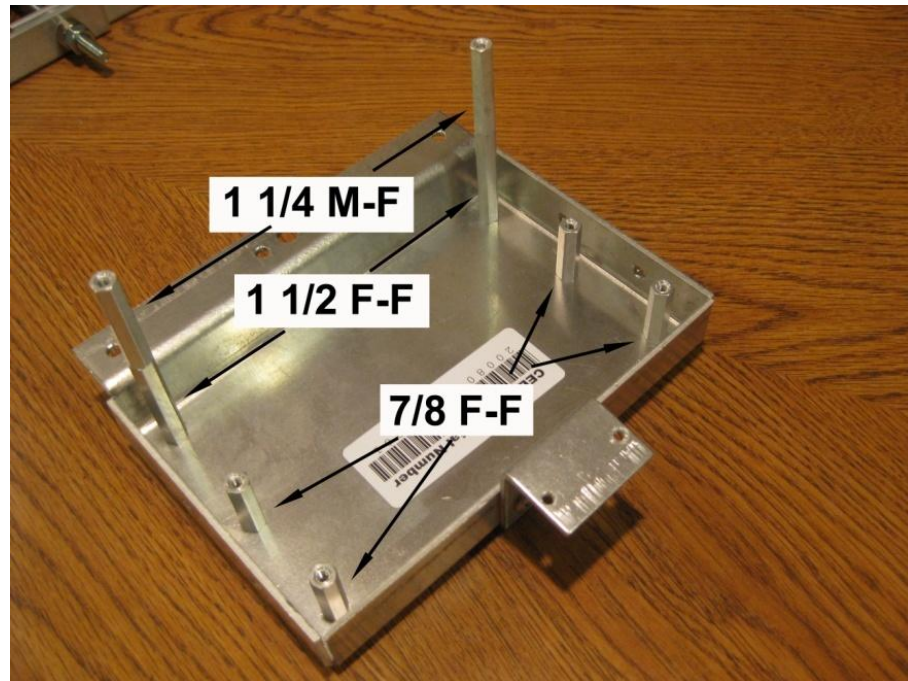
Assemble kingpin parts. Tighten nut so that it is snug but the sway bars still can move freely.



You can use a tapered punch or pencil to align the parts to ease assembly.



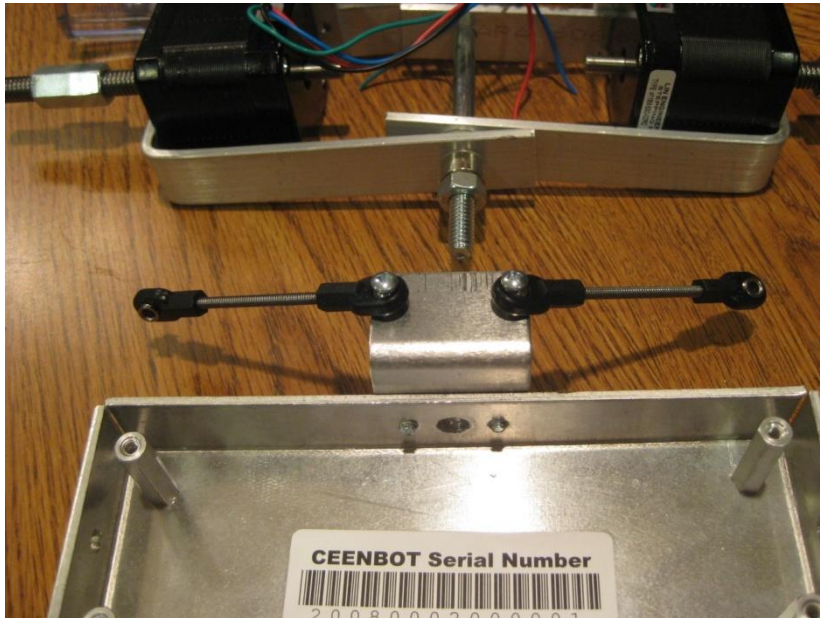
Place standoffs on aluminum tray as shown in the photograph. Use 6 – 32 x 1/2" screws. The rear 1 1/2" F-F standoffs will have 1 1/4" M – F standoffs screwed into them.



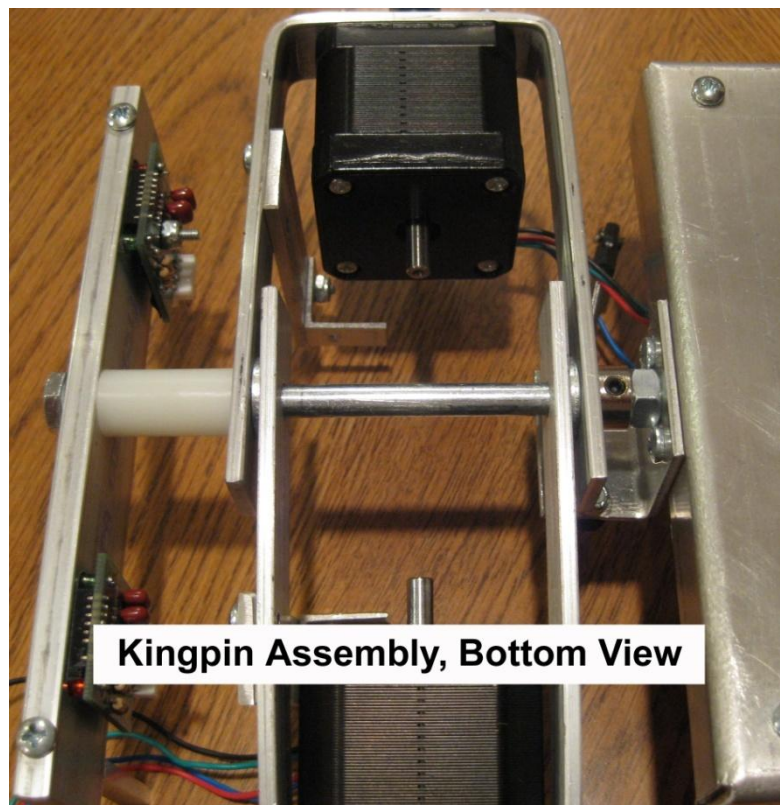
Attach the stabilizers to the tray as shown using 4x40x1/2" screws and locking nylon nuts.



Attach the tray to the Kingpin with the ¼" hex nut. Tighten securely.

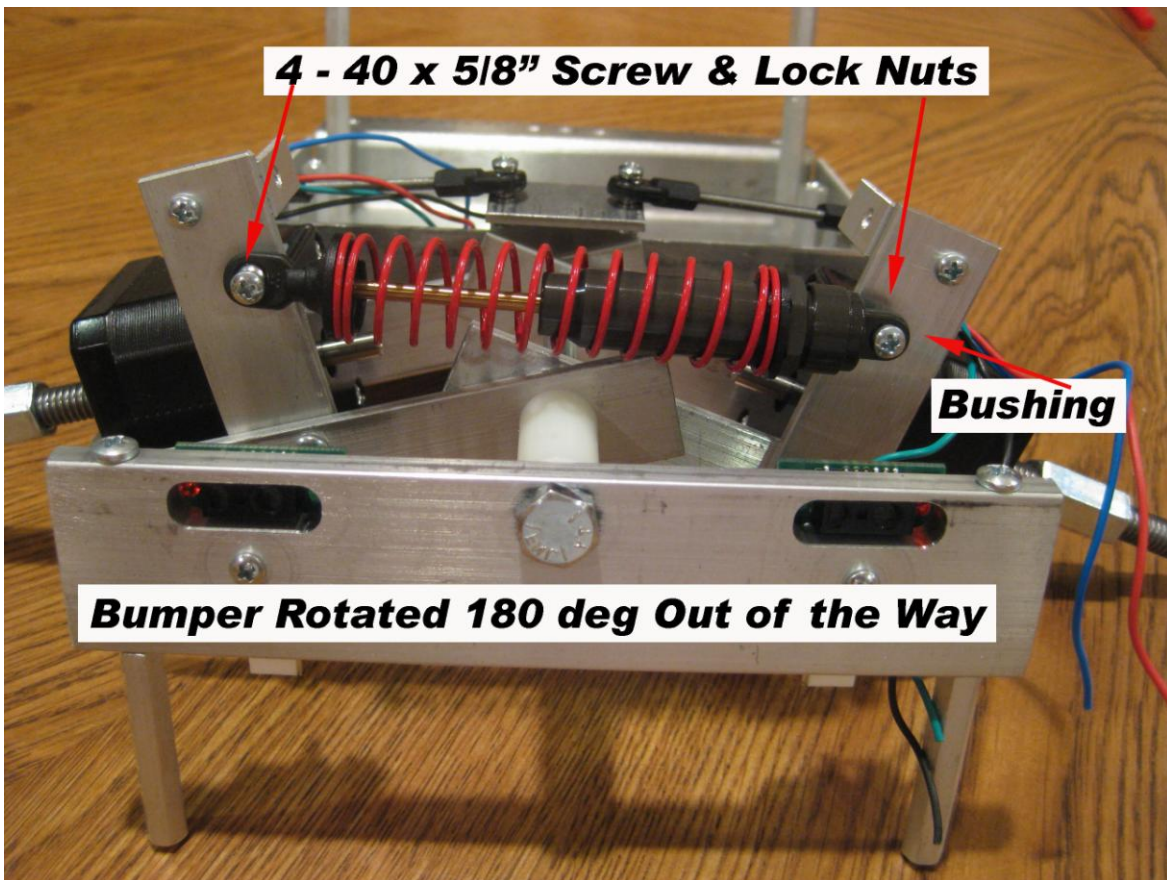


Kingpin Bottom View



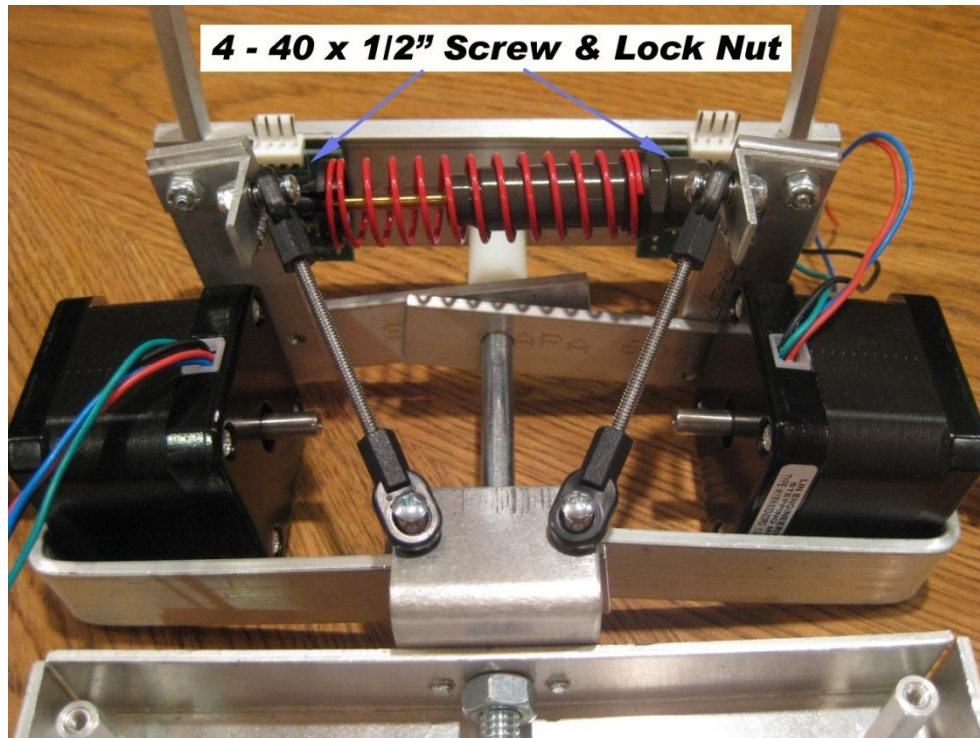
Attach Shock

Press the bushing into the plastic hole of the shock. Attach the shock to the shock towers with 4 – 40 x 5/8" screws and nylon lock nuts.



Mount Stabilizer

Attach the end of each stabilizer to its bracket on the shock tower. Use 4 – 40 x 1/2" screws and nylon lock nuts.



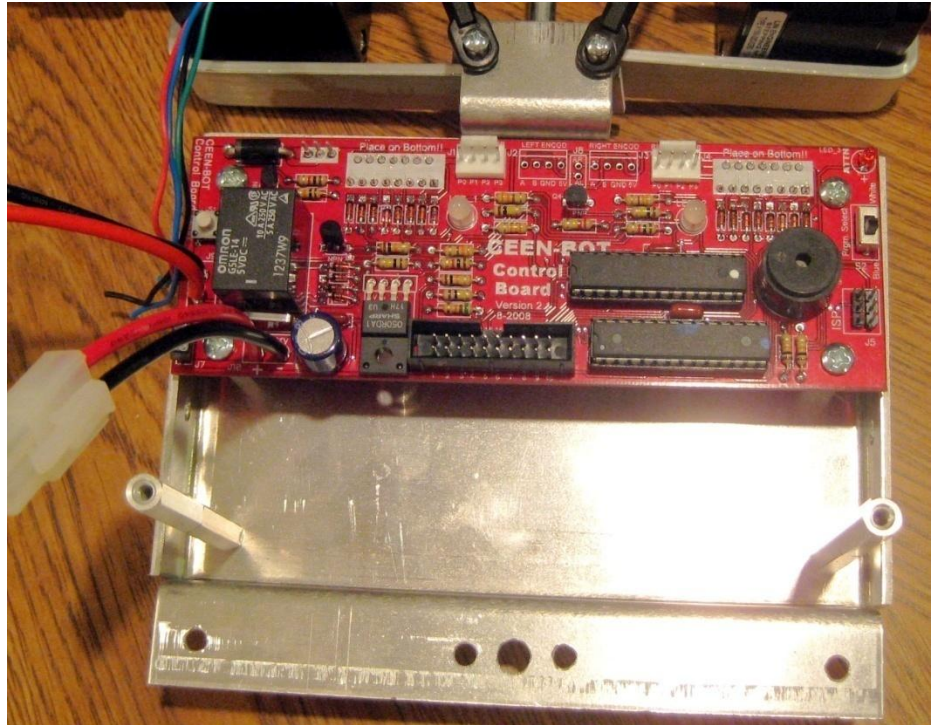
Insert Shims on shock

There are a variety of shims which can be placed on the barrel of the shock to adjust the stiffness of the suspension. Compress the spring and insert one of the larger shims over the barrel of the shock. There is a plastic collar that the spring presses against. Shim goes between this collar and the plastic end of the shock. Keep the remaining shims for future modifications of the suspension.

Control Board

Mount the Control Board using four 6 – 32 x ¼” screws.

Connect the right motor’s connector to the “Right Motor” connector on the Control board and the left to the “Left Motor” connector.

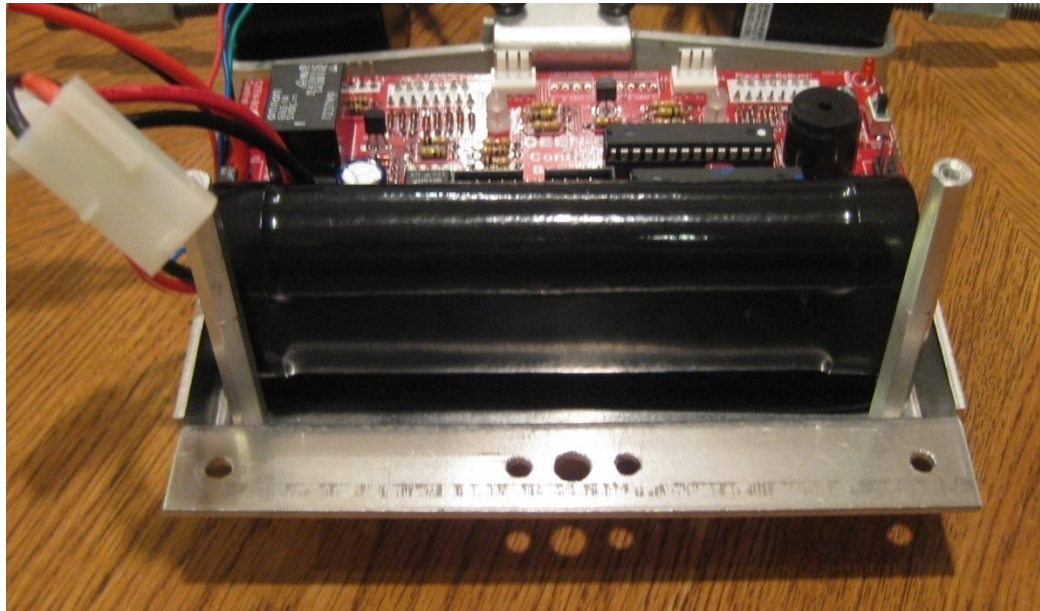


Installing the Battery

Remove the protective strip from adhesive on the “fuzzy” piece of Velcro. Press it onto the narrow edge of the battery. Attach the mating (hook) Velcro strip to the fuzzy strip. Remove the protective strip from the hook side of the Velcro. Carefully place the battery

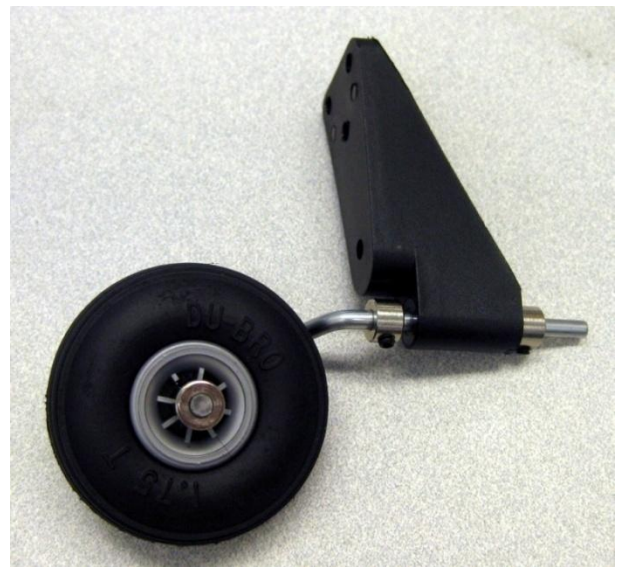


with the exposed adhesive into the open space on the tray behind the Control Board. Remove the battery and the Velcro will separate leaving the hook piece adhered to the tray. Press the hook piece so that it is fully adhered to the tray.

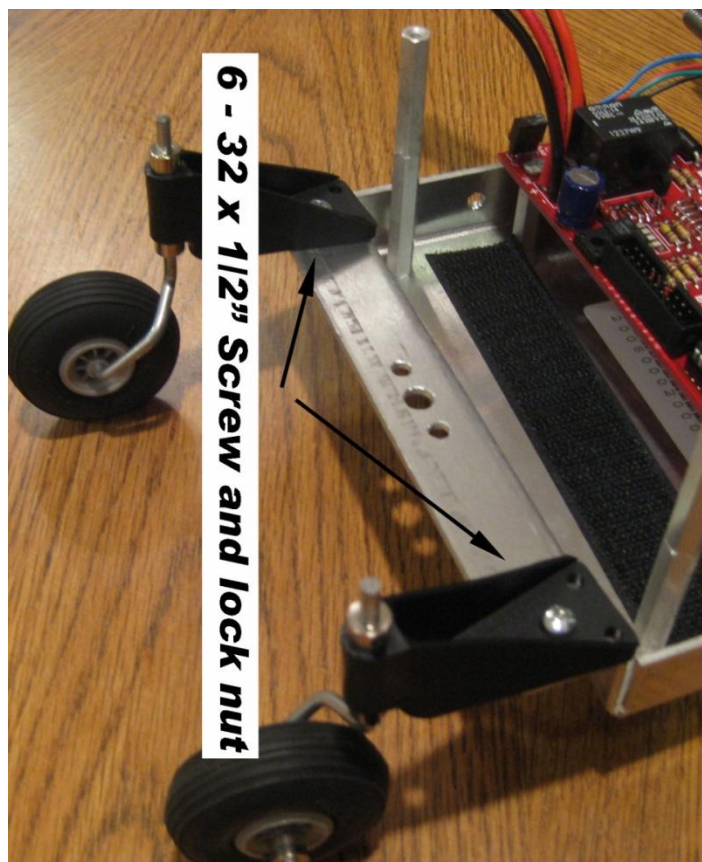


Installing the Tail Wheels

The bag with the tail wheel assembly has some very tiny set screws. **Be careful when opening the bag** that you don't lose them. Thread all of the set screws into the collars. Don't insert so far that they protrude into the center. Assemble as shown in the picture and tighten the set screws.



Mount the tail wheels to the tail ledge with 6 – 32 x 1/2" screws and nylon lock nuts. **Install with the lock nuts on the top.** **The photo shows them backwards.** The larger surface area against the plastic provides more strength and the plastic bracket is not as likely to break on hard landings.



Drive Wheels

Tire Assembly: Place the foam which came with the tires in the center of the tire and arrange such that there is a hole in the center.



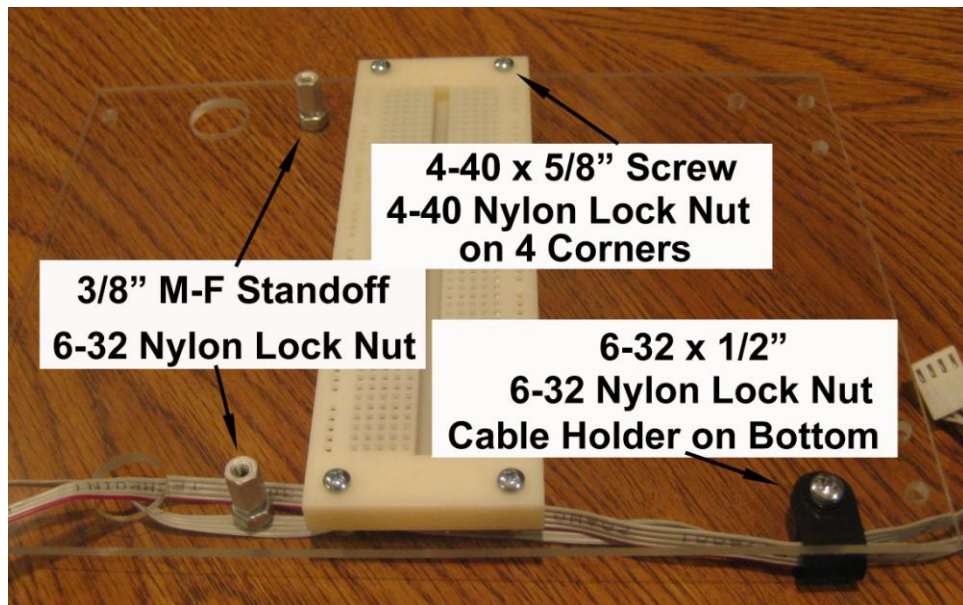
Work the tire over the wheel and adjust so that the tire bead is adjacent to the outer flange of the wheel.



Position the elongated inner bolt on the motor shaft such that it does not touch the frame when the motor turns. The exact position is not important. Attach the wheels to the motors using the hex nut. The molded hex depression in the wheel goes towards the motor. Use a socket wrench to tighten the nut. Do not over tighten or the plastic wheel may crack.

Plexiglas

Remove the protective film from the Plexiglas. Mount the prototyping board using 4 – 40 x 5/8" screws and nylon lock nuts. Observe the photo to make sure you are using the correct holes. Note the position of the large

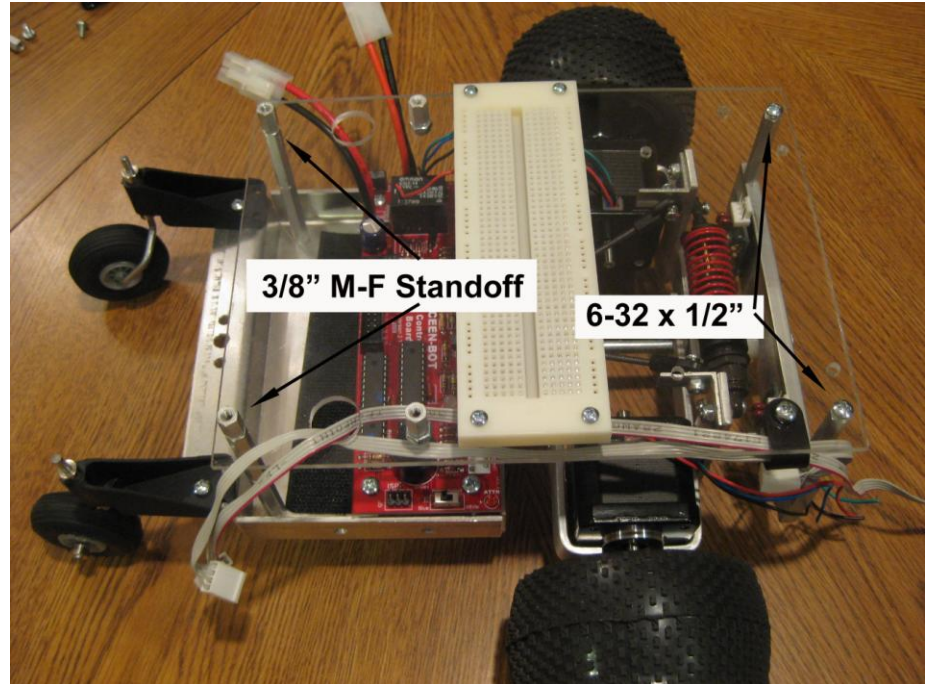


diameter holes that are used to feed the cables from the bottom to the top of the board.

Attach two 3/8" M – F standoffs with 6 – 32 nylon locking nuts as shown in the photo.

Place the two ribbon cables that will connect to the sensor boards in the cable holder and attach to the **bottom** of the Plexiglas with a 6 – 32 x 1/2" screw and nylon locking nut.

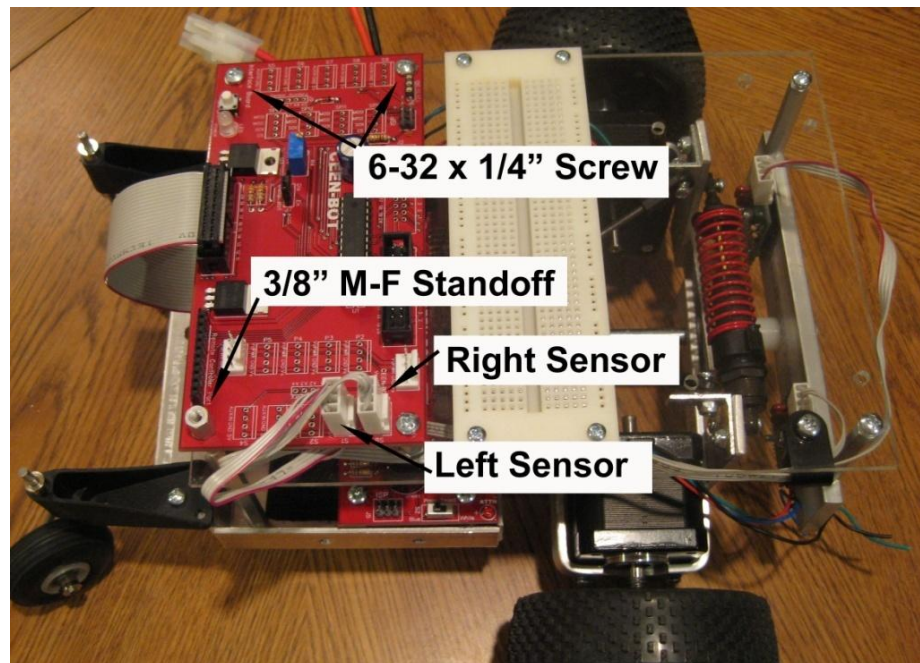
Attach the Plexiglas to the CEENBoT using two 6 – 32 x 1/2" screws on the front and two 3/8" M – F standoffs on the rear.



Interface Board

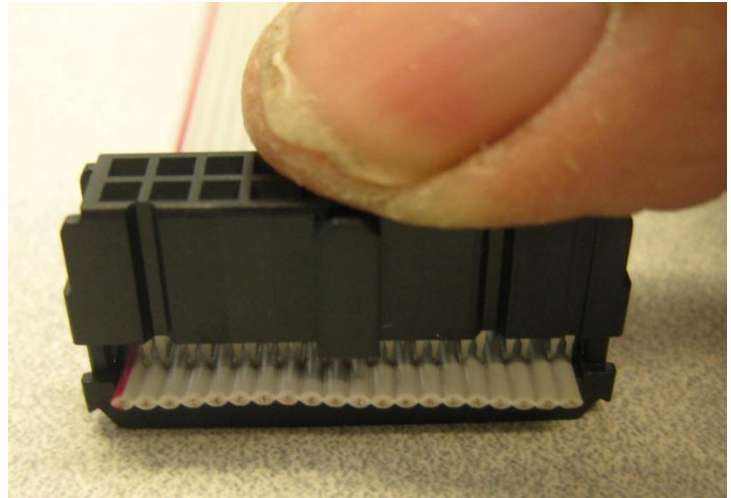
Attach the Interface Board to the four standoffs. Use a 3/8" M – F standoff on the right rear corner and 6 – 32 x 1/4" screws on the other three corners.

Place the cable from the left sensor board to connector S1 on the Interface board. Place the cable from the right sensor board to connector S0 on the Interface board. Route the wires through the cable holder and the hole in the rear of the Plexiglas.

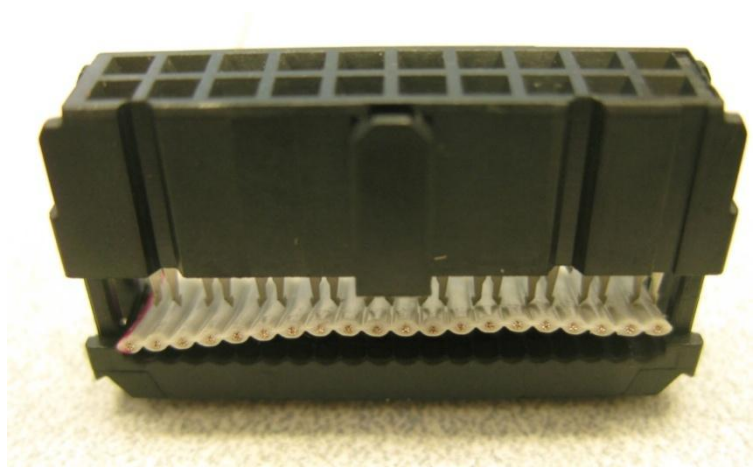


Ribbon Cable Construction.

Crimp a twenty-pin connector on one end of the 6" ribbon cable. Insert the cable through the opening. The side of the cable with the red marking can be on either side. The cable can extend slightly through the opening. **Note the connector key (the vertical plastic guide) is on the short end of the cable.**

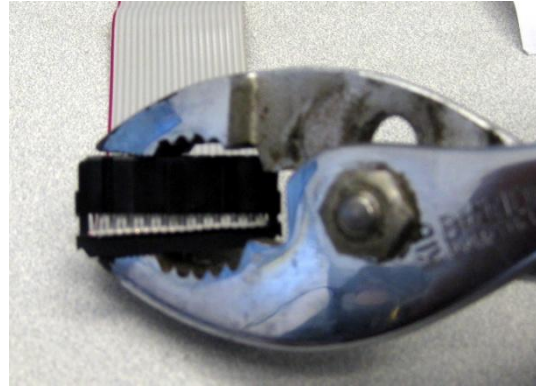
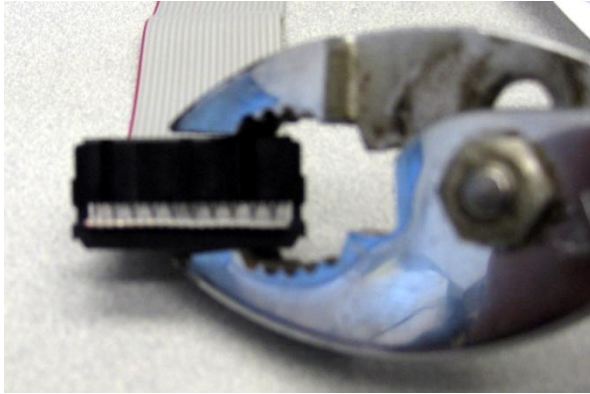


Press on the connector. You will hear two clicks as each end engages. The metal prongs should hold the wires in place.

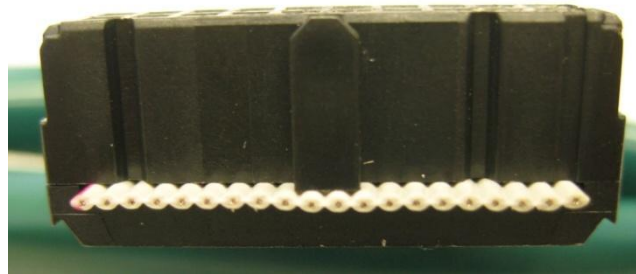


Use pliers to force the connector together. The type of pliers shown works well because they can exert fairly even pressure on the surface. Needle nose pliers usually do not work well.

Move the pliers to the other end to keep the connector parts parallel.



When completed, the plastic of the top part should be against the plastic of the other part.



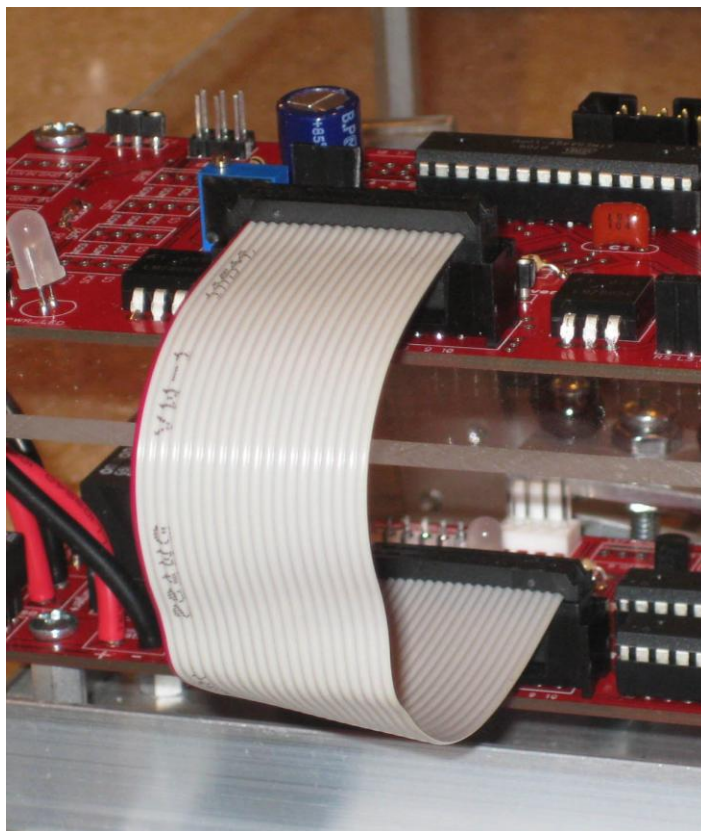
Before attaching the second connector to the other end

STOP and LOOK.

The **plastic key** goes to the stub end. The female sockets of one connector will point **up** and the other will point **down**.



Connect the ribbon cable to the back two connectors on the Interface and Control boards. The plastic key will only allow you to place it one way.



Connect the PlayStation controller card's 20 pin female connector to the 20 pin male connector located on the right side of the Interface card. The clearance in the male socket will allow the controller card's connector to be off by one pin in either direction. Visually check that it mates correctly.

Loop the cable from the PlayStation connector through a cable clamp and secure with a 6x32x 1/2" screw. Connect the PlayStation cable to the 8 pin male connector on the PlayStation controller card.

