

Power Systems 5
Cornerstone Electronics Technology and Robotics III
Power Systems 5 Lab 1 – Assembling Joystick Control Box and Tether for ROV

- **Purpose:** The students build the joystick control box and the 25' tether for their class ROVs.
- **Apparatus and Materials:** (See Parts List for Details)
 - 1 – Competition Style Arcade Joystick, RA-Joystick-JS10 from ABlackHorse.com Link:
<http://www.ablackhorse.com/store/pc/showsearchresults.asp?pageStyle=H&resultCnt=20&keyword=ra-joystick-js10>

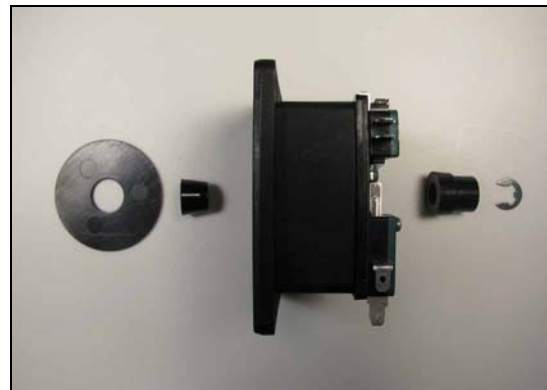
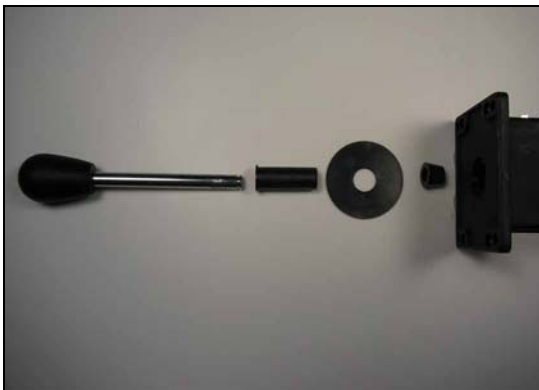


- 2 – 25' 16 Gauge Wires (Cut 100' 16/3 Extension Cord – Home Depot #277-525 into 4 – 25' Pieces)
- 1 – 25' 24 AWG/4 Pair Category 5e Network Cable (Jameco #645722)
- 1 – 5" L x 4" W x 3" H Aluminum Enclosure (Jameco #11886)
- 4 - #8-32 x 1/2" Stainless Steel Screws w/ SS Nuts and Washers
- 1/4" ID Rubber Grommet
- 8 - Female Disconnect Terminals by Ideal
- 2 - 1/4" Stud Size Ring Terminal
- Solder and Soldering Iron
- 1 – Automobile Fuse Holder
- 1 – 10A Auto Fuse
- 1 – Small Piece of Heat-Shrink Tubing
- 1 – 4 Contact Non-Polarized Connector Housing
- 4 – Female Crimp Pins

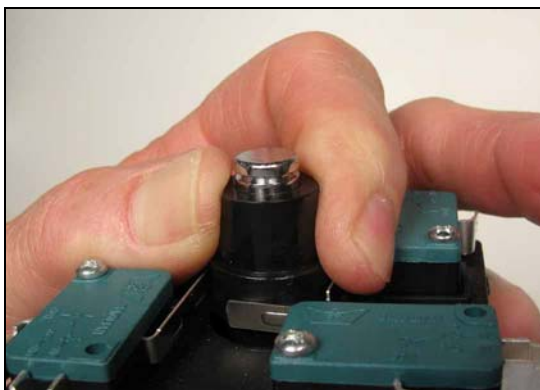
- **Procedure:**
 - **Assemble Joystick:**
 - Assemble the RA-Joystick-JS10 joystick with the parts in the order as shown in the photo below.



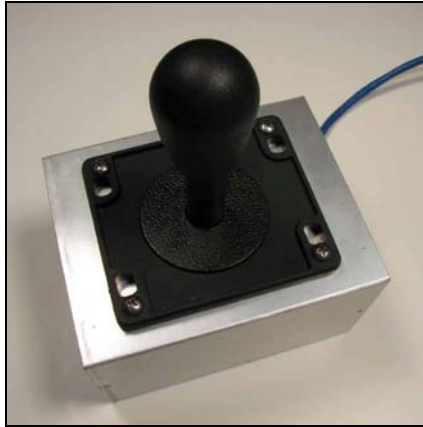
- Make sure each part is in the proper orientation.



- Hold down the plastic insert to expose the slot and push in the external retaining ring.



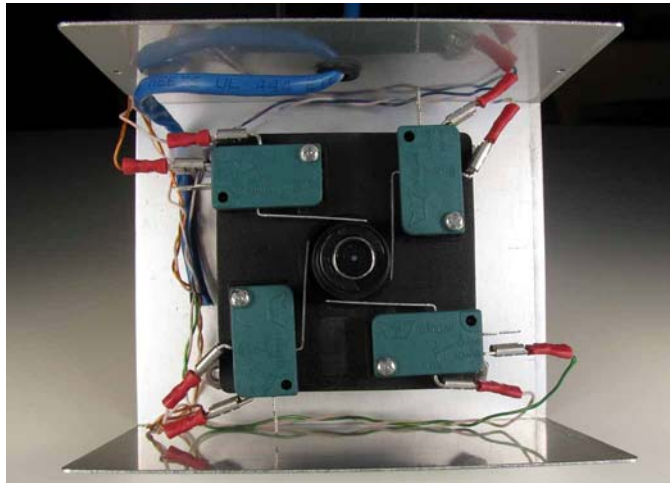
- **Mount the Joystick to the Aluminum Enclosure:**
 - Layout a 2 $\frac{3}{4}$ " x 2 $\frac{3}{4}$ " (7 cm x 7 cm) square hole centered on the 5"x4" side of the aluminum enclosure.
 - Use masking tape to tape over the aluminum outside the square hole so it won't be scratched when cutting the hole.
 - Cut a $\frac{1}{2}$ " hole inside the square hole.
 - Using a jigsaw equipped with a metal cutting blade, cut out the 2 $\frac{3}{4}$ " x 2 $\frac{3}{4}$ " hole.
 - Insert the joystick into the square hole cut and layout the holes for the mounting screws.
 - Drill the four mounting screw holes using a $\frac{5}{32}$ " drill bit.
 - Attach the joystick to the aluminum enclosure with #8-32 x $\frac{1}{2}$ " screws.



- **Mount the Grommet to the Aluminum Enclosure:**
 - Locate the spot where the Cat 5e cable will exit the aluminum enclosure.
 - Drill an $\frac{11}{32}$ " hole at this spot.
 - Insert the $\frac{1}{4}$ " ID rubber grommet into the hole.

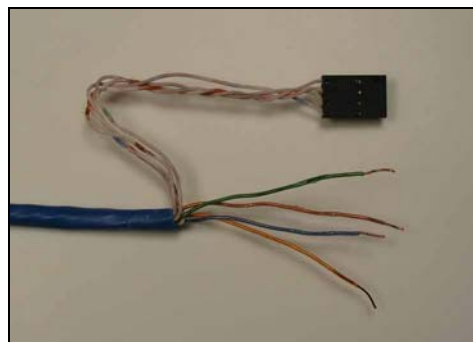
○ **Cat 5e Cable – End 1 Preparation:**

- Insert one end of the Cat 5e cable through the grommet into the aluminum enclosure.
- Now strip 6 mm of insulation off all 8 – Cat 5e cable wires that were inserted.
- Crimp female disconnect terminals onto each of the 8 wires in the Cat 5e cable.
- Connect the four twisted pair of wires to the four snap-action lever switch – one pair to each switch. Insert the female disconnect terminals onto the quick connect terminals, one to the Common (COM) terminal and the other to the Normally Open (NO) terminal. Secure the cable through the 3/16” cable clamp.



○ **Cat 5e Cable – End 2 Preparation:**

- Strip 3 mm of insulation off 4 wires and 5 mm of insulation off the other 4 wires at the other end of the Cat 5e cable.
- Crimp onto the 3 mm stripped wire, the 4 female crimp connectors that will fit into the connector housing.
- Insert the 4 crimp connectors into the housing.



○ **Extension Cord Preparation:**

- Strip back 8" (20 cm) of the outer insulation from one end of the extension cord.
- Cut 8" (20 cm) off the exposed green wire and discard.
- Cut 7" (18 cm) off the exposed white wire and discard.
- Slip on the heat-shrink tubing onto the fuse holder lead before soldering.
- Solder the automotive fuse holder onto the end of the extension cord white wire that was cut.
- Cover the solder joint and insulate with the heat-shrink tubing.
- Crimp the ring terminals onto the black lead and the fuse holder lead.
- For this lab, do nothing to the other end of the extension cord.



○ **Tether Assembly:**

- Align and stretch out the 25' – Cat 5e cable and the 25' – extension cord side by side. Place the ring terminal end next to the joystick enclosure.
- Starting in 5' (150 cm) from the joystick enclosure, zip tie the extension cord and the Cat 5e cable together using the 4" cable ties. Place a cable tie about 6" (15 cm). Cut off the cable tie excess over a garbage can.

