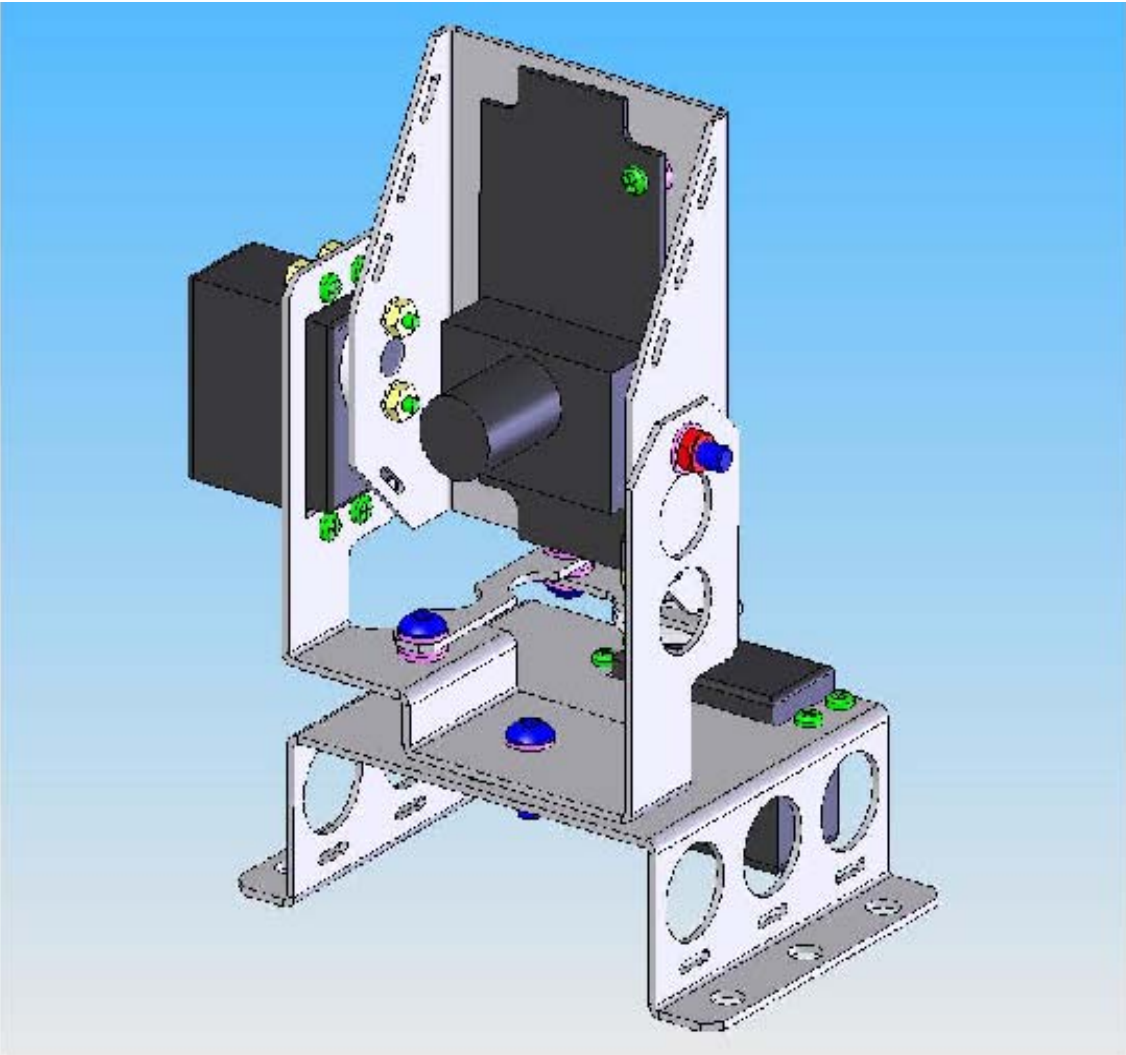


# CMUcam2 – Pan-Tilt Mechanism Assembly Instructions

December 8, 2005

Rev 1.0



## Required Tools

- Small Philips head screwdriver
- 1/8" drill
- Allen wrench
- Pliers

## Required Kits

2-**HiTec Servo, HS-322HD** each kit includes:

- "S" Type Servo Connector
- Heavy Duty Gear
- Case set
- Horn set
- Hardware set

**Camera Mounting Kit**, including:

- Camera mounts (PT\_BASE metal bracket, PT-Tilt-Bracket metal bracket, PT-CAM-MNT metal bracket)
- Camera
- Bag of assorted mounting screws, nuts and washers

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## Assembling the HiTec HS-322HD servo

1. Remove servo retaining screw, see Diagram 1
2. Remove plastic servo horn
3. Enlarge two pre-drilled holes shown on the diagram 2 to 1/8". Hint: Similarly drill the servo horn on the second servo for later use.
4. Install the four rubber inserts in the mounting holes. Note the rounded portion goes toward the servo.

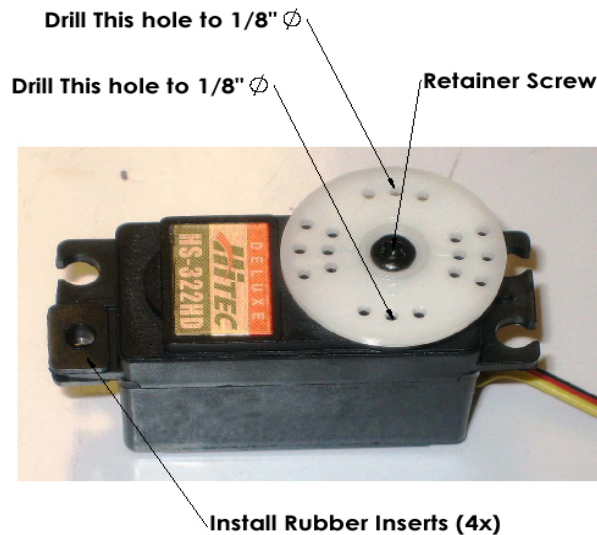


Diagram 1

5. Bolt the PT-Horn piece onto the Modified Servo Horn using (2x) 4-40 screws and Keps nuts found in the Bracket kit. See Diagram 2.

6. Bolt the Servo onto the PT-BASE metal bracket using (4x) 4-40 screws and Keps nuts.
7. The servo rotates through about 180 degrees. Rotate the shaft to the middle position and orientate the PT-Horn metal piece towards the top of the servo before placing it back onto the servo. Replace the screw.

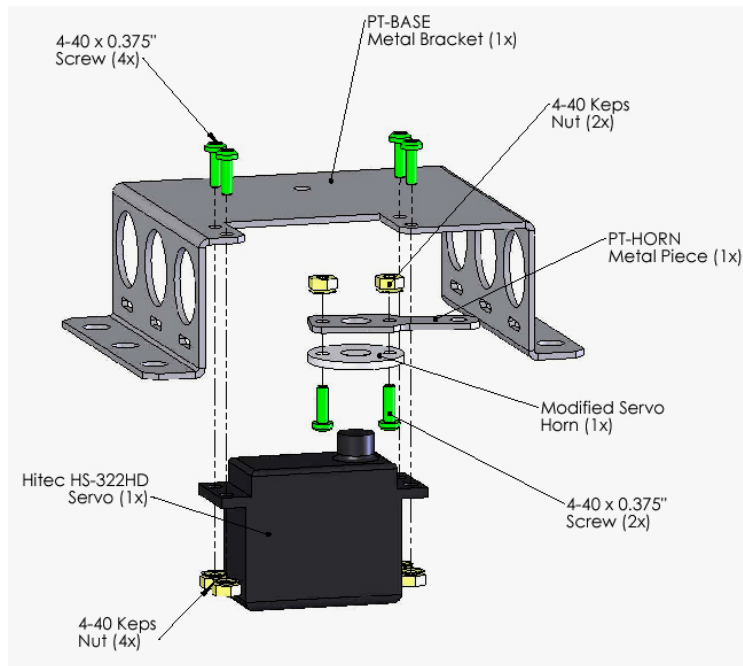


Diagram 2

### Connecting the PT-ARM and PT-HORN (Diagram 3)

8. Form the joint between the PT-ARM and the PT-TILT-BRK. Use the nylon washers as shown in Diagram 3 to reduce joint friction. Do not over tighten the screw the arm must swing freely.
9. Form the joint between the PT-TILT-BRK and POT-BASE as in Diagram 3. Do not over-tighten the screw, the assembly must swing freely.

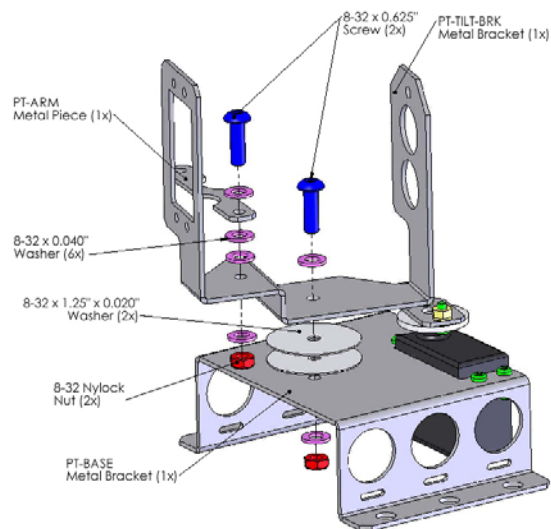


Diagram 3

10. Form the joint between PT-ARM and the PT-HORN. (Diagram 4)
- a. Rotate the assembly as in Diagram 4.
  - b. Using an 8-32x0.625" screw, three 8-32x0.040 nylon washers and an 8-32 Nylon nut connect the PT-ARM to the PT-HORN as in diagram 4. Do not over-tighten the screw as the assembly must move freely.

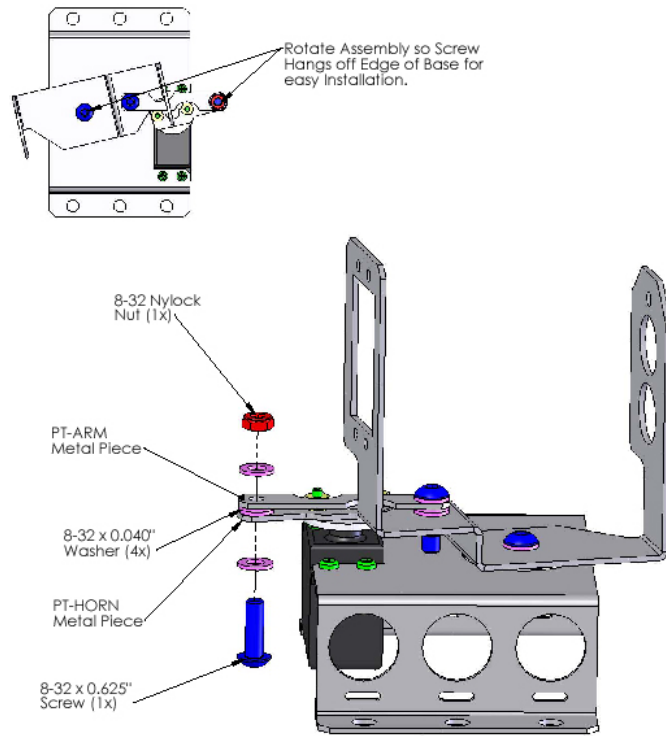


Diagram 4

11. To assemble the second servo to the PT-CAM-MNT metal bracket: (Diagram 5)
- Remove the Modified Servo Horn from the second servo unit and drill it as you did the first servo horn (Diagram 2). Sand lightly to remove any burrs.
  - Bolt it onto the PT-CAM-MNT metal bracket using 2 4-40 screws and Keps nuts. See Diagram 5.
  - Install the four rubber inserts in the servo's mounting holes. Note the rounded portion goes toward the servo.
  - Bolt the servo onto the PT-TILT-BRK using 4-40 screws and Keps nuts as show in Diagram 5.

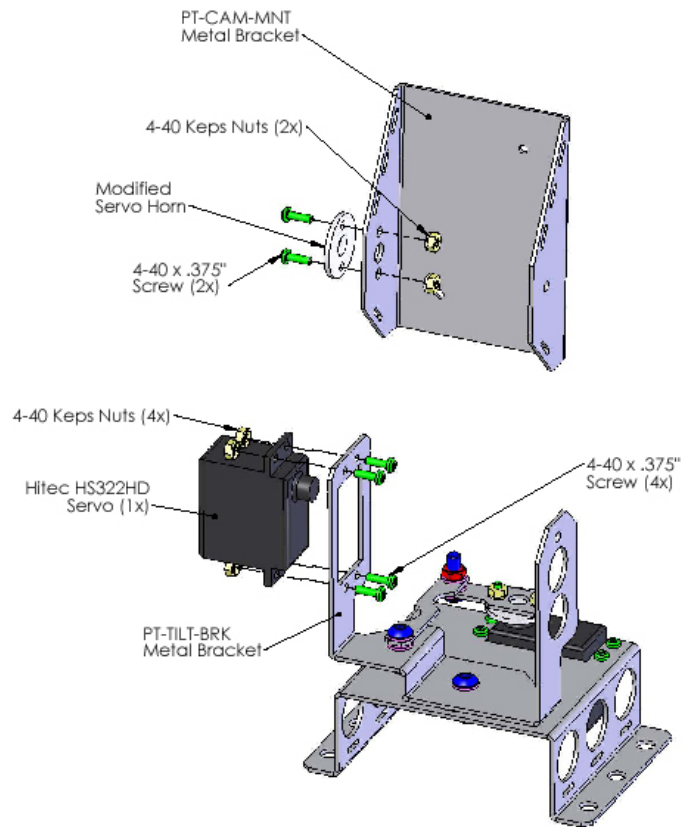


Diagram 5

**Attaching the PT-CAM-MNT to the PT-TILT-BRK (Diagram 6)**

12. The servo rotates through about 180 degrees. Center it to the neutral position.
13. Attach the tilt bracket to the camera mount as in Diagram 6.
  - a. With the tilt bracket in a vertical position slip the servo mount on the servo
  - b. Attach the right side of the tilt bracket to the camera mount bracket with an 8-32x0.625" screw, 4 nylon washers and an 8-32 Nylock bolt. Do not over-tighten the screw as the mount needs to move freely.
  - c. Install the retaining screw back into the modified Servo horn.

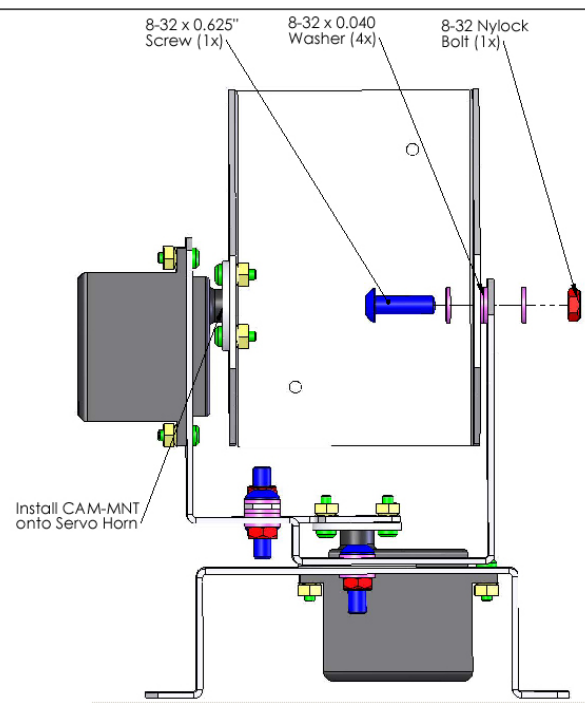


Diagram 6

**Attaching the camera to the camera mount (Diagram 7)**

- 14. Orient the camera so the lens is towards the bottom of the unit, as in Diagram 7
- 15. Attach it to the camera mount with a 4-40x.375 screw, 3 8-32x0.40 washers and a 4-40 Keps nut in each of the cameras top and bottom mounting holes.

Note that the three washers are required to offset the cameras circuit board from the metal bracket. The camera may alternatively be mounted in a Radio Shack Project box and the box attached to the tilt bracket with Velcro.

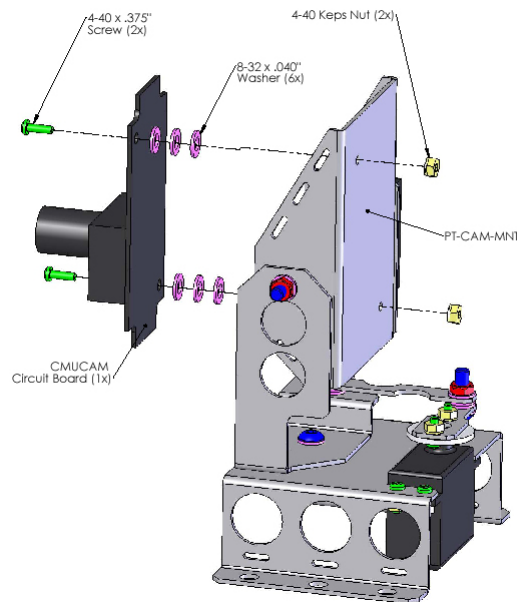


Diagram 7

**Complete the assembly**

- 16. Insure that the retaining screws have been reinserted into the Modified Servo Horns
- 17. Inspect all joint bolts, making sure they are as tight as possible without hindering free movement.
- 18. Ziptie all cables in provided slots.

