Mecha TE

Limited Edition Animatronic Hand

Instructions

Thank you for your investment in Custom Entertainment Solutions' animatronic hand that will bring years of performance to come. Your brand new hand has been engineered and manufactured to our high standards for dependability, ease of operation, and maximum performance value. If the instructions that follow are followed closely it will bring you years of performance.

General Safety Rules

- As with any machine with moving parts, be careful not to let body parts get pinched. While the hand has very little gaps and it may be difficult to get trapped in them, it could potentially catch on clothing, rings, etc.
- When operating this hand apply a maximum of 5 VDC to the micro servos. Anything above this voltage will destroy the small servos and will void the warranty.
- When working on the hand make sure all power to the servos is turned off.
- When the hand is at rest and not performing all power should be turned off.
- While this hand has compliance (mechanical "give") built into all fingers, it is still possible to cause bodily and collateral damage with this hand if it is attached to an arm or mechanism that is not carefully controlled. As Custom Entertainment Solutions has designed the hand only, of course the end-user is responsible for using this hand in a safe manner.
- If excessive force is applied to any finger or thumb it may destroy the servos. Compliance minimizes this risk, but it is possible to destroy *any* mechanism.

Basic Instructions and Tips

- Your new hand is equipped with [Futaba S3114 Micro Servos](#). At any point in this hand's lifespan:
  - o DO NOT Exceed 5 volts DC (VDC) to the servos. A [4.8 to 5 max volt battery](#) supply is ideal to ensure this voltage is never exceeded.
  - o DO NOT apply excessive force to the fingers / thumb. This is multiplied by the time it translates to torque on the servo horn. This will cause damage, typically resulting in "stripped" gears but can also damage the internal servo electronics.
  - o DO NOT get this hand wet. The mechanisms contain black-oxide steel hardware which will rust if not cared for. The servos are not water-resistant either.
- Compliance Adjustment:
  - o Each finger (but not thumb) is equipped with a servo saver system. The two shaft collars on either side of the servo horn brass connector (at the ends of the springs) and be moved to compress or de-compress the springs to your liking. See Figure A.
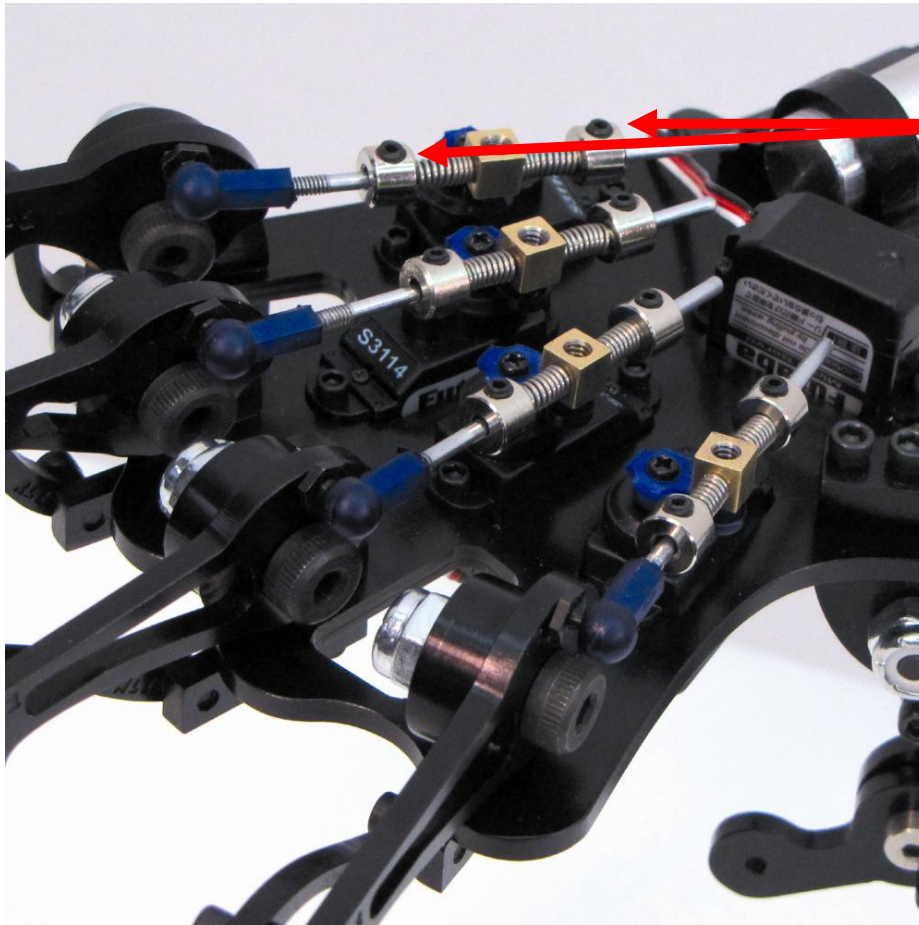

Figure A

- These shaft collars can be adjusted to compress springs more or less in each finger.
- Less compression in the springs = more compliance in the finger
- If the springs are not adjusted equally per finger this will shift the neutral position of the finger (which can be beneficial at times)

- When programming this hand in whichever servo controller / microcontroller / radio control system you choose:
    - Be very careful to define limits on each finger / thumb. The new hand has shipped with all servos at a "0" position (roughly translating to 1500 ms). At this position we have installed and tuned the finger / thumb mechanisms to be at a relative "0" position. This means that as you power up the hand for the first time and without inputting any position commands other than "0" or "neutral" the hand will move very close to the neautral position it takes when resting on the packaging it was shipped on (the plastic form).
    - To find the end limits for each finger / thumb:
        - Because of the infinite position possibilities you have when adjust this hand's compliance, it is impossible for Custom Entertainment Solutions to predict – for each system – what those limits will be on your control system. You will have to set these yourself.
        - To set the end limits first unplug ALL servos except the servo you are now tuning.
        - Using this servos address on your control system carefully move the servo (using whichever commands are applicable to the control system you choose. Those using a decent radio control system will be able to do this in the servo limit / endpoint adjustment dialog on the transmitter). Move this servo in small increments and LISTEN. When you hear the servo slightly "hum" and do not see any more motion in the finger / thumb in the direction you are traveling BACK THE SERVO DOWN immediately. Leaving it at this point will damage the servo. By backing the servo down (changing the value to slightly closer to your neautral position value) you will extend the life of that servo and battery system powering the hand (stalled servos pull more amps than servos with a near-zero load).
        - Repeat the above for the opposite direction of that finger / thumb.
        - Repeat this process above for each finger.
        - While this sounds incredibly time consuming consider this:
            - If you do not change the compliance you will not have to do this again.
            - Using VSA from Brookshire Software it takes us only 10 minutes to tune a whole hand.

Troubleshooting

While Custom Entertainment Solutions has had client's install this had design around the world for years and have reported no issues (save one client putting in 7 volts to servos!), allow us to think of the worst case possible and offer quick tips on how to fix it:

Finger / thumb is not moving

- Check your power supply. Is it connected? Is it supplying at least 3.5 volts or your minimum servo controller's recommended voltage?
- While it is not moving, a noise from the servo is a steady "whirring" sound. If this is the case you have applied too much force to the servo and stripped the internal gears. Inside the micro servo the motor is grinding plastic against plastic. If this is a recurring issue you might try a Futaba S3156 metal gear micro servo. Slight adjustments in the hand mounting plate and / or servo mounting holes may be necessary. This modification would void the warranty but may help your particular situation.
- Double check your servo controller. Is it receiving / sending signals appropriately? Have you tried plugging a loose, new servo into the same port to test? If that servo works, then see the above tips.

Fingers / thumb are moving but erratically

- As with any robotic / animatronic project, many times this will come down to a complex system interaction between your microcontroller / pc and the servo controller. Usually the servos are just fine. Here are some things we have found with testing done on multiple PC's and servo controllers:
  - Number one cause of this is almost always a "noisy" power supply.
    - Even though you may have carefully selected an AC to DC 5VDC output supply that can handle 1 A pull, it may not be producing a quiet voltage.
    - Try plugging in a simple battery supply (NOT over 5 VDC). In all cases this has corrected this issue in our testing.
  - Any control system can be riddled with connection issues. Servos are usually the most trouble-free devices in the entire loop. If the above does not solve the issue, backtrack into your servo controller settings (BAUD rate mis-match, etc), cable connections, EMI interference, and your code.
- Mechanisms may have been subject to dirt or adverse conditions. This can be confirmed by disconnecting the mechanism from the servo. If it still "binds", carefully apply a PTFE-base lubricant to each joint. If there are still issues the hand will have to be carefully disassembled, cleaned, re-assembled w/threadlocker, and tuned as above.

Example Applications

Motion Activated

Robotic Human Size Animatronic Hand Motion Sensor

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Activated by a motion sensor, this quick example shows how the Mecha TE LE can be used with any microcontroller or sensor system. This project required a simple BASIC stamp and a PIR motion detector module.

Summary

This hand can be used in a variety of applications. As you find your creativity applied to this hardware, please send us your proud results! The world would like to see your work in action.

Best of luck!