# Rangefinder Servo and LED Controller Board
## Hyperdyne Labs, © 2001
### http://www.hyperdynelabs.com

## Overview

The rangefinder servo and LED board will fit inside a Fett helmet and allow you to motorize the rangefinder using a standard off the shelf servo.  The board also controls 2 LEDs, which come on automatically when the rangefinder is the down position.  These LEDs can be fitted in the rangefinder head or other relevant place.  The board also has 2 inputs to control the up and down motion of the servo.  The servo can be controlled to go up and down using a myriad of interfaces, including momentary pushbuttons, voice recognition board, or an IR/radio link.  Here is a pic of the unit:



The board has a header of 9 pins that are used to hook up the external "activation" interface, which is used to tell the servo when to go up and down.  The LEDs are also connected up to these pins.  The header has labels on it that correspond to the pin function.  Pins 1 and 2 are the up and down interface pins.  Pins L1 and L2 are the negative side of the 2 LEDs.  The last 4 pins are the common leads that you should connect to the positive side of the LEDs and interface pins.  The board runs of a 9V battery or other DC source < 12V.

## Servo Connections

Any off-the-shelf 4.5-6V servo will work, as long as it has enough torque to lift your rangefinder.  You can plug your servo right onto the controller board.  A 3-pin header is there to connect the servo.  **NOTE THE POLARITY!  The servo ground is near the small resistor on the end of the board, and the servo control line is near the main chip.  Make sure you plug the servo in correctly or it can be damaged!**  The black wire on the servo is GROUND (-).  The red is POWER (+).  The control wire is typically yellow or white.  A picture is shown below.

Top of servo board
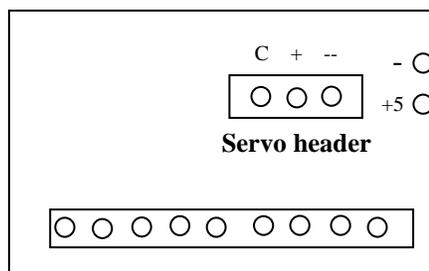
## Servos Tested

Here is a list of the tested servos with the board:

Tower Hobbies:  Hitec HS-77BBJ, http://www2.towerhobbies.com/cgi-bin/WTI0001P?Q=1&I=LXN620
Jameco:  #157067 - HS303 robotic servo, http://www.jameco.com
FMA Direct:  PS30, https://www.fmadirect.com/home.htm

**NOTE:**  The tested servos were able to travel 120 degrees with 1-2ms input control pulses.  The board is tuned for this, so the servo travels only 90 degrees for the rangefinder head.  If you have a servo that travels a maximum of 90 degrees with 1-2ms input pulses, contact us and we will get you a new chip for your board so that the rangefinder head will travel all the way up and down.

## Button and LED Hookup

Here are the connections for the 2 LEDs and 2 pushbuttons.  The pushbuttons are used to control the servo direction.

Top of servo board

header

1  2  3  L1  L2       vcc x 4

up

down

-   +

LEDs
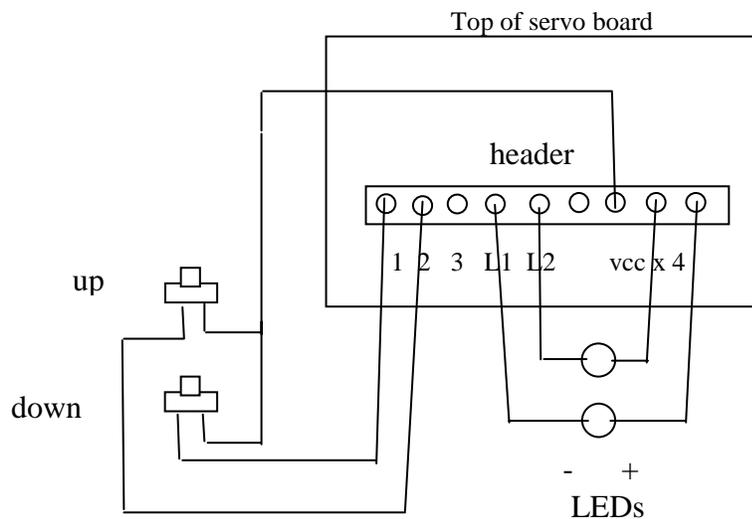
## Mode Selection

When the board powers up, it selects the "interface" mode via the onboard slide switch.  The 2 inputs on the board respond to high signal, i.e., when a logic "1" is seen on the pin, the servo responds.

The 2 input interface modes are:
1) Normal up/down servo controller mode.
2) Automated up/down servo controller mode.

In mode 1), the servo travels up and down as long as the button or other interface input is pushed or activated.  This is the mode to use for a pushbutton, IR or RF link, etc.  This gives you total control over the final position of the servo by the amount of time the input is active.

In mode 2), the servo goes all the way up or all the way down with just one button press or pulse on the interface pins.  This mode is used for the voice recognition board or other input that only pulses the input pins briefly.  The servo will travel a full 90 degrees (up or down) and automatically stop in this mode.  In mode 2, the servo board also waits for 4 seconds upon power up before accepting commands, which is used to allow the voice recognition board time to boot up.

In both modes, when the servo travels all the way to the down position, it activates both LEDs.  The LEDs blink in a sequence which mimics the pinging sound seen in ESB.

NOTE:  Upon powerup, the servo will also reset itself at high speed.  The servo will go to the up position automatically, so the board knows where the RF position is.  In mode 1), the servo resets right away.  In mode 2) the servo waits 4 seconds (to allow the voice rec or other interface board to settle), then resets itself.

## Voice recognition board to control servo

The servo board can be used with an off-the-shelf voice recognition board.  The board tested is the Sensory Voicekit 364.  This board can be found at www.sensoryinc.com

The Voicekit board does need some assembly.  For the servo application, I set up the voice board for multi-word CL (continuous listening) mode.  In this mode, the voice board will listen for a predetermined command before it toggles one of its output lines.  You can use up to 3 commands in this mode.  You can use the first 2 available commands to activate the servo to go up or down.

Follow the instructions for assembling the voicekit in CL mode.  Then train the board with 2 voice commands, like "Targeting activated" for the down command, and "Deactivate targeting" for the up command.

Connect the voicekit header pins OUT1 to the servo board header pin 1, and the voicekit header pin OUT2 to the servo board header pin 2.  This will complete the connections so the voice board will toggle the servo board inputs when a command is recognized.  Make sure the servo board is set up for mode 2).

Also, the voicekit needs +5V to run properly.  No problem.  There are 2 pads on the servo board labeled "+5" and "-".  They are located just above the large chip with the metal tab.  You can run 2 wires from here and connect them to the power and ground wires of the voicekit board.  Now, the servo board will power up the voicekit board also, which allows you to just use the one battery for the entire system.

## Voice recognition board connections

Here are the relevant connections for the voice kit board connected up to the servo board.
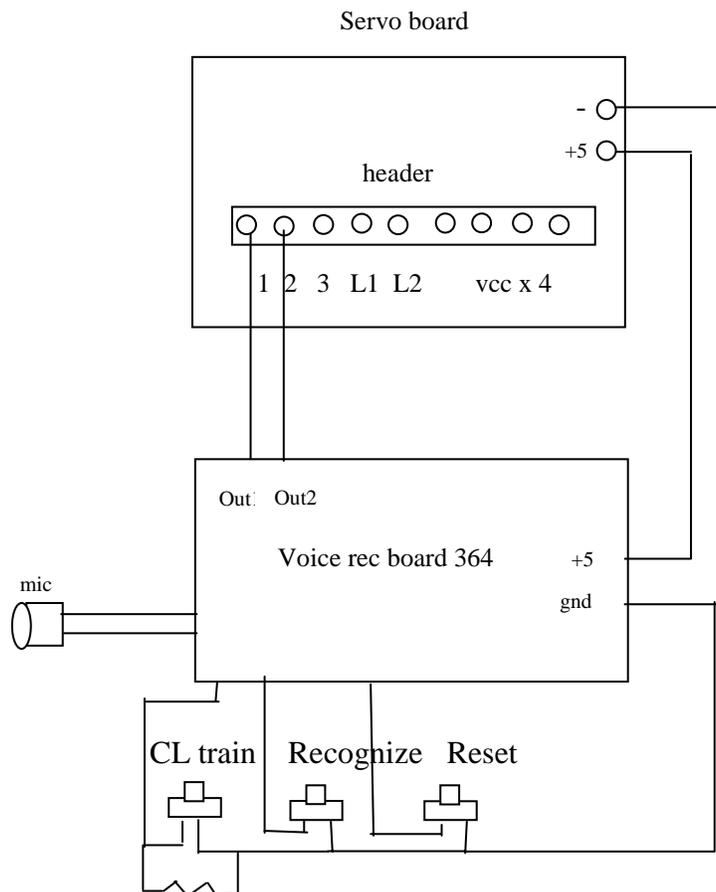
## Servo install into helmet (courtesy C. Hunt)

First you need to carefully pop off the outer ear piece that covers the rangefinder stalk. Then I drilled a 23/64 hole as shown, starting with smaller drills to make it easier to get centered. You will also have to smooth out the area where the rangefinder stalk travels.



I used one of the adapters that came with the servo and glued it to the inside part of the stalk to connect it to the servo.
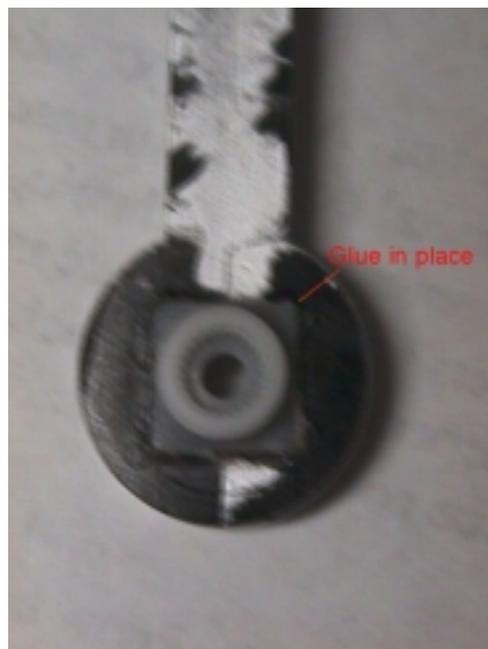
After the glue set up, I put the servo in the helmet attached the rangefinder. Making sure that the servo was set in up position I adjusted it so the rangefinder was pointing straight up. I used the rubber bushings and screws that came with the servo to hold it in place. I was only able to get three of the screws to bite into the helmet, but it seems stable.
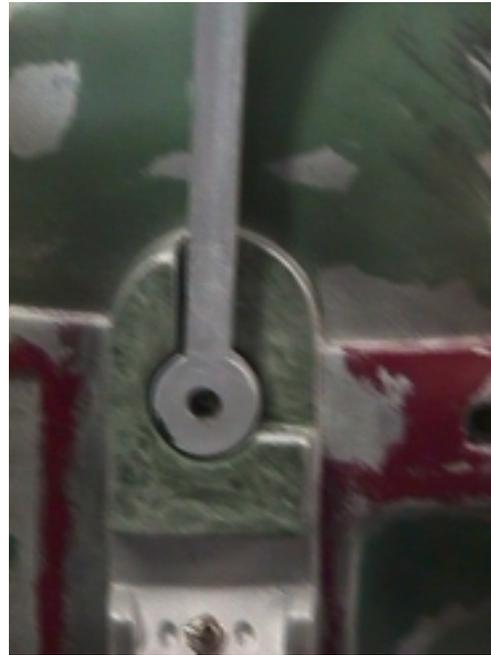


You will have to grind down or file the post that the rangefinder was rotating on so the the outside ear piece will fit back on. Right now I am using double faced foam tape to hold the outside earpiece on so that I can make adjustments rather than glue.

Here is the finished helmet. I did a repaint on the helmet from the standard DP and had Richie install a full visor.

## Voice recognition board install

Make all the relevant connections of the Voice Direct 364 kit in multi word CL mode.  Here is a picture of an assembled 364 kit.
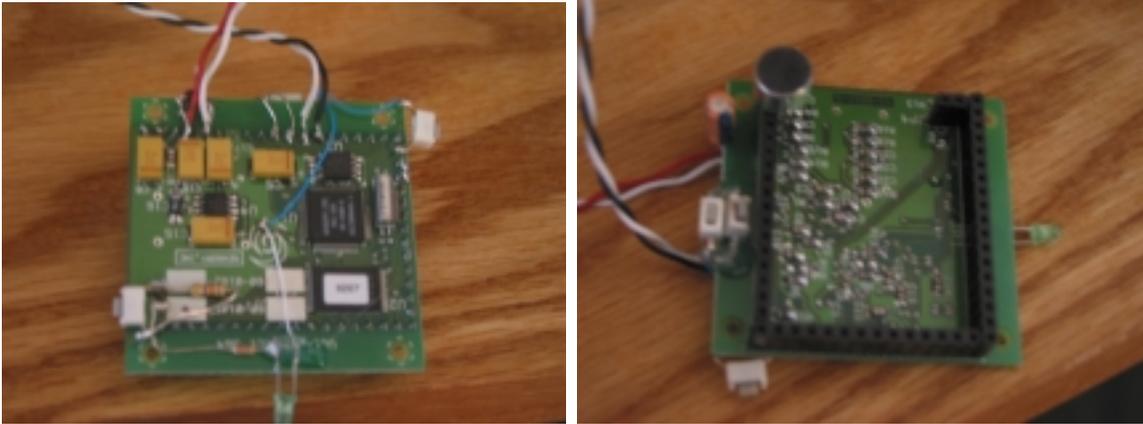


The buttons, resistor, mic, LED, were connected to the circuit via the 364 instructions.  Also the speaker for training was only attached during the training sequence.  After this it was removed.  You can keep it attached and install it in your helmet if you wish. This will give you some feedback for recognized words. The LED also will inform you.

Here is the entire voice rec system installed in a Fett helmet.

## Using your Voice recognition board

If your 364 board was assembled, here is a picture to help you learn the buttons.
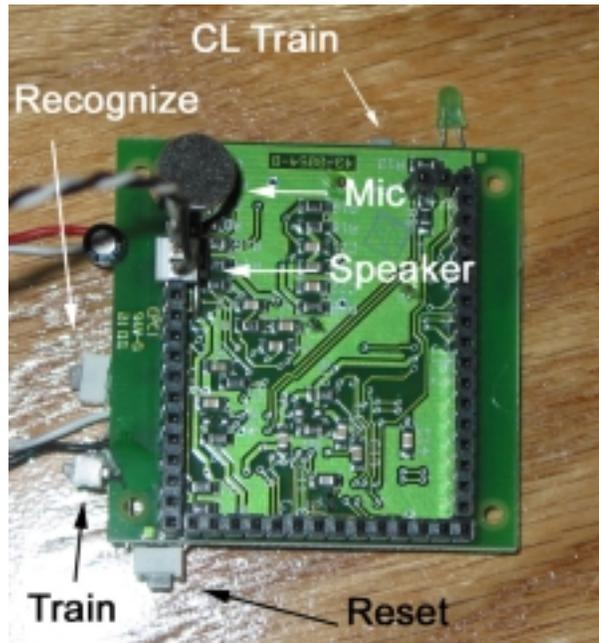


The speaker hooks into pins 6 and 7 shown above. The microphone connects to pins 2 and 3. Plug the speaker in only for training purposes. When you are done training, you can remove the speaker so you don't have to install it in your helmet.

When you power on the voice board, it will beep, so that is good. That means it booted up ok. Having this sound come out when you hit reset is also good. The LED should come on and stay on.

Push the Recognize and Train buttons at the same time to clear the memory on the board. The speaker will verify this.

You then need to train the voice board with the 2 commands that you want to use to lower and raise the rangefinder. So, put the board in your helmet in the environment you are going to normally talk to it. With the speaker plugged in, press the CL train button. The board should respond with a voice prompt "Say word 1". You then say whatever the RF down phrase is (like "activate targeting"). The board will ask you to repeat it, then do so (wait a second or 2 or it will keep giving you a training error). If everything went ok, it will say "training complete"

Push the CL train button again. It will ask for word 2. Train the RF up command (like "targeted off" or something) and go through the same setup. When that word is trained, you are done. Finally, hit the Recognize button and the board is ready to work. The LED will come on

Speak the phrases in the same tone, speed, etc, and the board will tell you when it recognized the phrase. The LED will also go off for a second. If you made the right connections to the servo board, it will go up and down automatically when the phrase is recognized. After you get this far, you can remove the speaker and just reattach it when you want to do a retraining. The LED should tell you when the phrase was recognized when in your helmet.

The included Voice Kit manual also tells you how to work the board. See the multi-word CL mode in the documentation if you are having problems.

## Radio link board to control servo

If you would like to use an RF link to control the servo, you can do this also.  As long as the RF receiver board can feed a TTL signal to the servo board, this should work like the voice recognition instructions below.  If you power the receiver board and servo board from the same battery, all you need to do is to provide a TTL signal to the servo inputs 1 and 2.

One board you can use is part #6082-KT from www.mpja.com.  This board has not been tested but does give you an idea on how to go about doing this.  The relay outputs on this RF receiver board can be connected to the switch inputs 1 + 2 and to the vcc pins on the servo header (just like you are connecting up 2 pushbuttons).  When the relay trips, the corresponding input will control the servo automatically.