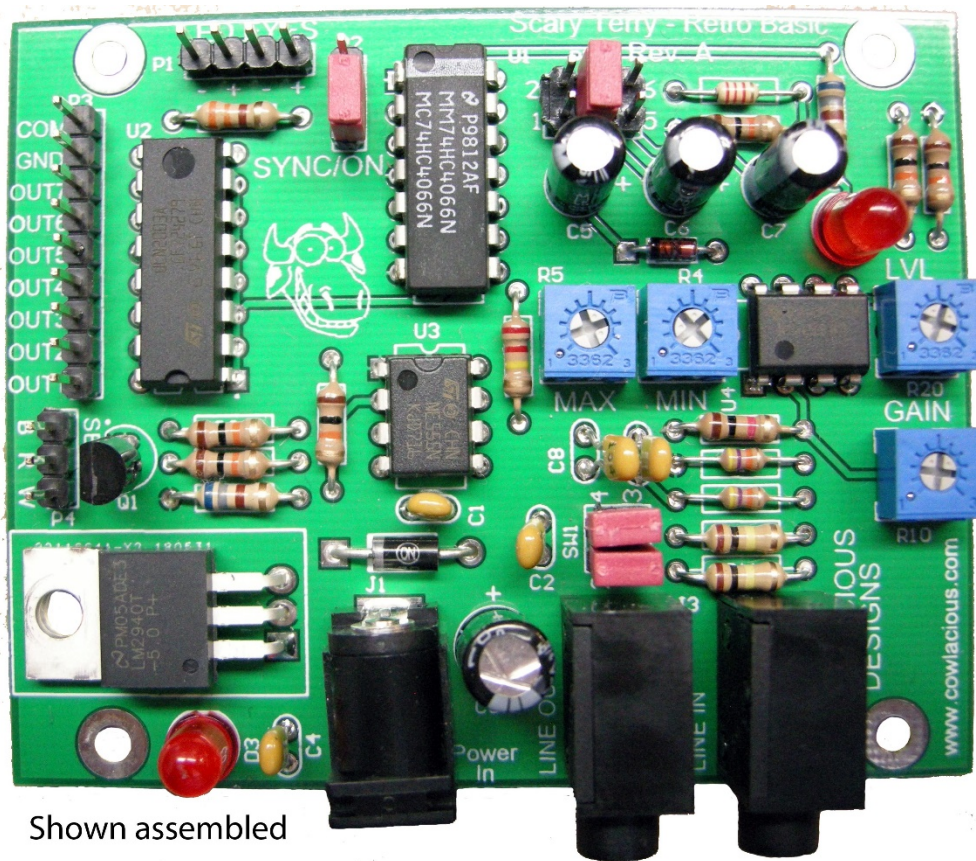# Scary Terry – Retro Board Kit

Shown assembled

Cowlacious Designs™
By Computer & Electronic Services

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Introduction:

Scary Terry has allowed us at Computer & Electronic Services to produce a Cowlacious Designs circuit board from his original design. Over the years we have changed it a little bit, but the main circuitry is still Terry's! We thank him for the great circuit he designed for everyone to enjoy!

Scary Terry describes the circuit as follows:

"My goal in creating this was for a simple, inexpensive and reliable circuit that doesn't require programming a microcontroller for each individual movement. I've used several of these circuits over the last couple of Halloween's to drive Bucky (skeleton skull) and other animatronics heads, and they worked all night long without fail."

"As long as there is sound present, the servo will drive to its "max" position. If the sound is short in duration, the servo will not have time to drive to "max" but will drive part way and return to "min" position. While this method of moving a mouth is not perfect, it's pretty good and I'm very happy with the effect. It's important to remember that any sound will drive the servo, voice, music or noise, so if you're trying to make a Bucky mouth move to a voice track, you shouldn't have music in the background of that particular track."

Terry's web site is:

http://www.scary-terry.com/

Parts list for Scary Terry's Audio Servo Driver

Count	Label-Value	Designation(s)
1	Scary Terry Circuit Board	ST-425
2	680Ω Resistor (blue, grey, brown, gold)	R2, R9
2	47K Resistor (yellow, violet, orange, gold)	R14, R17
1	1KΩ Resistor (brown, black, red, gold)	R12
5	10KΩ Resistor (brown, black, orange, gold)	R6, R8, R16, R18, R19
1	2.2KΩ Resistor (red, red, red, gold)	R15
1	4.7KΩ Resistor (yellow, violet, red, gold)	R7
2	100KΩ Resistor (brown, black, yellow, gold)	R11, R13
1	220KΩ Resistor (red, red, yellow, gold)	R3
1	330Ω Resistor (orange, orange, brown, gold)	R1
1	1N914 or 1N4148 switching diode	D4
1	1N4001	D2
1	1458 or 4558 op amp I.C.	U4
1	555 timer I.C.	U3
1	ULN2803 I.C.	U2
1	74HC4066 I.C.	U1
1	5KΩ Variable Resistor (502)	R10
1	1KΩ Variable Resistor (102)	R20
1	50KΩ Variable Resistor (503)	R4, R5

2	1/8" (3.5mm) Stereo Jack	J2, J3
5	0.1uF disc capacitor	C1, C2, C4, C8, C9
1	2N4401 transistor	Q1
2	Red LED	PWR (D1), LVL LED (D3)
1	3 Pin Header	Servo (P4), Sync/On (P2)
1	4 Pin Header	LED EYES (P1)
1	9 Pin Header	P3
1	3x2 Pin Double Row Header	P5
1	2x2 Pin Double Row Header	SW1
1	220uF electrolytic capacitor	C3
1	2.2uF electrolytic capacitor	C7
1	4.7uF electrolytic capacitor	C6
1	10uF electrolytic capacitor	C5
1	Barrel power supply connector	J1
1	L7806 Voltage Reg.	VR1
1	#6 screw, ½"	Screw
1	#6 nut	Nut
4	Red Shorting Cap	
2	LED Eyes Cable	Audio Eyes Cable
2	LED, Clear Ultrabright Red	Audio Eyes Cable
2	Short pieces of heat shrink tubing	Audio Eyes Cable

Construction

☐ Remove the components from the packaging and check to make sure that all of the parts are there.

☐ Look at the circuit board and identify the component side of the board. This is the side with the white silk screen for the components. The outlines for the components are marked D1, U1, U2, etc. This is the side of the board that parts will be placed on. DO NOT SOLDER ON THIS SIDE OF THE BOARD. Solder parts in place by soldering the leads on the opposite side of the board.

☐ Install resistor R1. Solder in place and trim the leads.

☐ Install resistors R2 and R9. Solder them in place and trim the leads.

☐ Install resistor R3. Solder in place and trim the leads.

☐ Install resistors R6, R8, R16, R18, and R19. Solder them in place and trim the leads.

☐ Install resistor R7. Solder in place and trim the leads.

☐ Install resistors R11 and R13. Solder them in place and trim the leads.

☐ Install resistor R12. Solder in place and trim the leads.

☐ Install resistors R14 and R17. Solder them in place and trim the leads.

☐ Install resistor R15. Solder in place and trim the leads.

☐ Install diode D4. Make sure the band on the diode matches the band on the circuit board. Solder it in place and trim the leads.

☐ Install diode D2. Make sure the band on the diode matches the band on the circuit board. Solder it in place and trim the leads.

☐ Install the chip I.C.'s: U4 (RC4458 or LM1458), U3 (555), U2 (ULN2003), and U1 (74HC4066). **Make sure the notches on the chip are facing the same way as shown on the silkscreen of the circuit board.** Solder in place. Note: If you find it easier, place and solder one chip at a time.

- ☐ Install the variable resistors R4, R5, R10 and R20. R10 has 502 written on its side. R20 has 102 written on its side. R4 and R5 have 503 written on its side. Solder them in place and trim excess leads.

- ☐ Install J2 and J3, the stereo 3.5mm audio "Line In" and "Line Out" jacks. Solder in place.

- ☐ Install the 0.1uF ceramic disc capacitors C1, C2, C4, C8, and C9. Solder in place and trim the leads.

- ☐ Install Transistor Q1, orienting it in the position shown by the silkscreen on the circuit board. Solder in place and trim the leads.

- ☐ Install the LED "PWR" orienting the LED as shown on the silkscreen of the circuit board.

- ☐ Install the LED "LVL LED" orienting the LED as shown on the silkscreen of the circuit board.

- ☐ Install a 4-pin header in the P1 location. Solder in place.

- ☐ Install a 3-pin header in the P4 location. Solder in place.

- ☐ Install a 3-pin header in the P2 location. Solder in place.

- ☐ Install a 9-pin header in the P3 location. Solder in place.

- ☐ Install a 3x2-pin dual row header in the P8 location. Solder in place.

- ☐ Install a 2x2-pin dual row header in the SW1 location. Solder in place.

- ☐ Install electrolytic capacitors C3 (220uF), C7 (2.2uF), C6 (4.7uF), and C5 (10uF). Solder in place and trim the leads. **Make sure to orient the capacitors positive and negative leads correctly. The negative side is marked with an arrow down the side of the capacitor. The positive side is marked on the circuit board.**

- ☐ Install the L7806 voltage regulator into location VR1. Solder in place and trim the leads. Note: The backside of the L7806 should be facing the "Scary Terry – Retro Board" text on the board.

- ☐ Install a red shorting cap onto the middle pins of J8 to select the 4.7uF capacitor.

☐ Carefully check your soldering job to make sure all the connections are soldered and to make sure that no solder bridges have occurred that would connect items that shouldn't be connected.

Constructing the LED Eyes cables:

☐ Measure down ¼" from the bottom of the LED's and cut the leads off (there should be ¼" leads sticking out of the bottom of the LED).

☐ The LED has ridge around the bottom of its case that is shaved on one side, this is the negative lead. Put one lead in the end of one of the LED Eyes cables with the negative lead over the black wire. Push the LED all the way in.

☐ Slip the piece of heatshrink tubing over the LED and down over the connector on the LED Eyes cable. Shrink the tubing around the base of the LED and LED Eyes cable end by applying heat from a heat gun, blow dryer, or rubbing a hot soldering iron tip over it.

☐ Repeat for the other LED Eyes cable.

☐ Congratulations, it is now time to test and adjust the circuit.

Testing and Adjustment
(Note: Please see connection diagrams on the following pages.)

☐ Connect your servo to the servo header. Make sure you properly orient your servo connector with the header. The header is marked with "Y R B", where Y is for Yellow, R is for Red or positive, and B is for Black or Negative. (Colors for the yellow wire will vary by servo manufacturer, but the Red and Black are usually there.)

☐ Supply power to the board by connecting a 9 VDC (1000mA) power supply to the barrel connector. **Center pin is positive, sleeve is negative.** You should see the "PWR" LED light up as soon as power is applied.

☐ Adjust the threshold level, "LVL" (R20), clockwise or counter-clockwise until the "LVL LED" turns on.

☐ Adjust "MAX" (R5) until the servo is in the maximum position you would like it to move to. This is maximum open mouth position.

☐ Adjust the threshold level, "LVL" (R20), clockwise just far enough that the "LVL LED" turns off. Note: This control is used to set the sound trigger level needed to make servo head toward the MAX setting. If it is set too far from the point that the LVL LED turns on the servo will not respond to the sound at all or not as much as desired.

☐ Adjust "MIN" (R4) until the servo is in the position you would like it to move to. This will be the closed mouth position. Don't close it so much that the jaw clenches or it could cause the servo to overheat.

☐ Feed audio to the circuit through the 3.5mm stereo "Line In" jack. If you want both channels of sound to control the Scary Terry – Retro Basic then make sure that the red shorting jumpers are on SW1. If you want only the right channel of audio to control the servo, then remove the red jumper from the switch for left channel. If you want only the left channel audio to control the servo then remove the red jumper from the switch for the right channel.

PLEASE NOTE: Both channels of the audio are always passed on to the "Line Out" jack. The "Line Out" jack can connect to an external set of powered computer speakers, powered MP3 speakers, or it can feed the Aux or Line In jack of an amplifier that has speakers connected to it.

☐ Adjust the "Gain" until you get the kind of response you want. Remember, this circuit is designed to move the servo to its maximum position whenever audio is present. If the audio is too loud it will remain in its maximum position until the "Gain" is adjusted to an appropriate audio level. If the audio source has an adjustable output, such as an MP3 players headphone jack, you will probably need to turn the players volume up to maximum.

The "Gain" adjustment and the "LVL" adjustment work in conjunction with each other, so you may need to experiment a little bit with these controls to get the effect you want from the sound source you are using.

☐ **OTHER AJUSTMENTS AND CONNECTIONS**
There are three header pins on J6 with a red removable jumper across the two middle pins. This header allows you to fine tune how quickly the circuit responds to sounds. In the middle position it is using a 4.7uF capacitor. If you move the jumper over two pins to the right, facing the audio jacks, it will use a 2.2uF capacitor, speeding the reaction time up a little. If you move the jumper to over the other direction it will be using a 10uF capacitor which will slow the reaction time down a little.

☐ **High Current Section (J10)**
The high current driver of the Scary Terry board allows the board to control devices such as small DC lamps, relays, and solenoids for air and water. This section can be used to control props that require larger eyes than LED's appear to be and/or to control a jaw that is just too big for a servo to be able to control.

Each of the 8 channels is capable of sinking 500mA of current. We don't recommend pushing it that hard without attaching a heatsink to the chip, but that is what the specs for the device say.

The chip can sink up to 24VDC devices, even though the Scary Terry board is only a 5VDC board.

SUPPLIED OPTIONAL DEVICES

☐ LED AUDIO EYES
The Scary Terry board is also provided with two two-pin headers for LED Audio Eyes. Our LED Audio Eyes can simply be plugged onto these connectors. These eyes will flash with the sound just like the "LVL LED" on the circuit board flashes to the sound. When attaching our LED Audio Eyes, make sure the black wires connect to the pin with the "-" symbol and the yellow wires connect to pin with "+" symbol. The "SYNC/ON" header allows you to make the eyes always on or flashing with the audio, depending on which position the red shorting jumper is placed. Just about any color LED will work fine with these connections (clear ultrabright red LED's are supplied).

OPTIONS AVAILABLE FOR PURCHASE
Please see our web site at www.cowlacious.com

☐ 9VDC, 500MA, WALL TRANSFORMER THAT PLUGS INTO THE "PWR2" JACK.

☐ HITECH 425BB SERVO

☐ 3.5MM TO 3.55 STEREO CABLE (ONE IS PROVIDED)

☐ 3.5MM TO RCA CABLE

☐ HIGH CURRENT WIRING ASSEMBLY
The high current section on the board allows for higher current devices to be controlled by the Scary Terry Audio Servo Driver board. This connection allows devices such as small lamps, relays, and solenoids for air and water to be controlled in sync with the audio, just like the LED Audio Eyes. These devices will turn on and off in sync with the "LVL LED".

The Wiring Assembly provides an 9-pin connector with 6" wires for making connections to the circuit board header easier.

Troubleshooting Tips

Besides making sure there aren't any solder bridges, here are a few other things to check:

1) Make sure that R12 hasn't been swapped with R6, R8, R16, R18, or R19. It is sometimes hard to tell the difference between orange and red on the resistors.
2) R14 & R17 should be a 47K (yellow, violet, orange, gold) and R7 should be 4.7k (yellow, violet, red, gold)
3) Make sure all the chips are in the correct direction.

Special Thanks to Scary Terry (Terry Simmons) for letting us use his original design for this product!

We hope you enjoy it!

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