

AQUARIUM LAMP CONTROLLER

ORNAMENTAL AQUARIUMS are features of many living rooms. Once these showpieces were only found in the homes of aquatic enthusiasts who lovingly attended to the needs of the watery inmates — checking temperatures, feeding twice a day, cleaning, removing excess algae, adjusting pH and salt contents and so forth.

With the rise in popularity, labour saving devices started to appear on the market. Automatic fish feeders appeared and heaters that cycled themselves on and off reduced the amount of attention the aquarium required. So why shouldn't the lamps do the same?

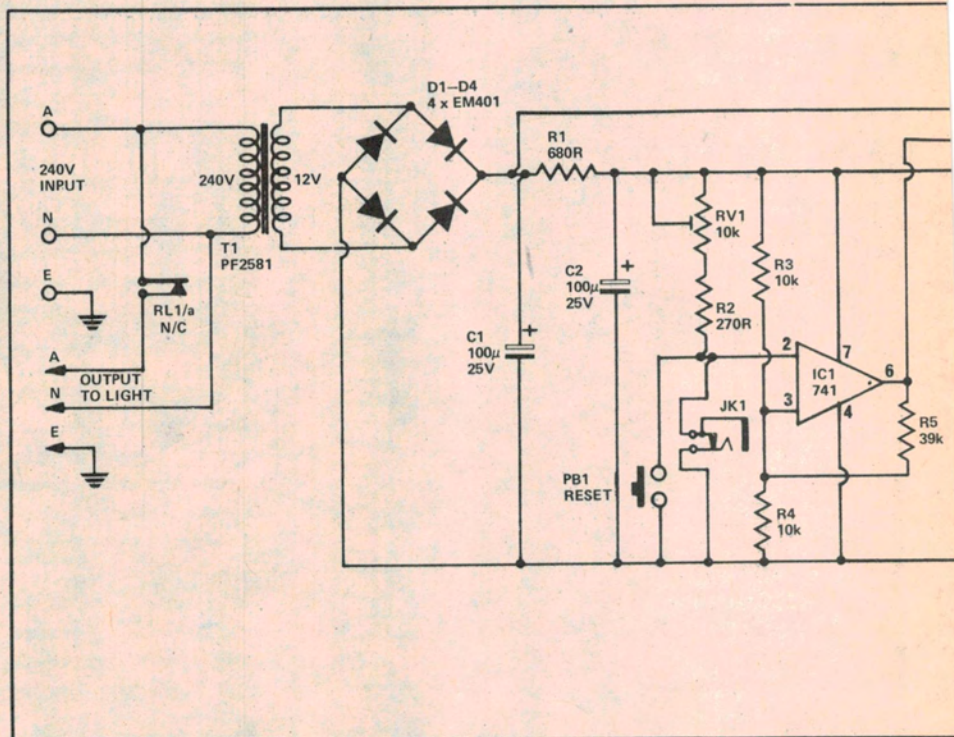
Desirable Features

The lamps used in over-tank housings are generally of the 'Growplus' type. The manufacturers of these tubes suggest 15-16 hours per day of illumination.

A simple device which turns the lamps on at sun-up and off at sundown would not deliver sufficient illumination. The controller described maintains the aquarium light on for some time after sundown providing adequate illumination, and has the advantage that the tank remains lit into the evening, which is when it looks its best.

In addition, three control functions are made available. Firstly, a reset button is provided to restart the timing period. If guests are expected or if the tank needs to be kept illuminated, irrespective of whether it is on or off, pushing the button recommences the delay period before switch-off. Secondly a winter/summer switch is used to allow selection of the time period after sundown before light-out.

In the middle of winter, when darkness sets in at about 5.30 pm a four hour delay gives a suitable light period.



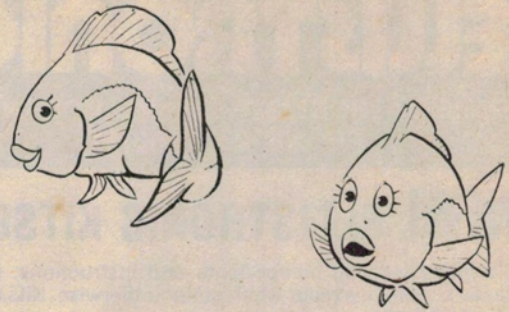
In summer, with Daylight Saving, 1½ hours is quite adequate.

It is also occasionally necessary to inhibit operation altogether — such as when some 'cure' has been placed in the water. Many of these must be used in the absence of lights or aeration. For these reasons an 'off' switch is provided. While it is possible to use the light switch provided on most assemblies this can be inconvenient. For example, if the lamp assembly does not have one itself and the power point is inaccessible, or if the aeration pump has been connected as well (in the interests of a silent night).

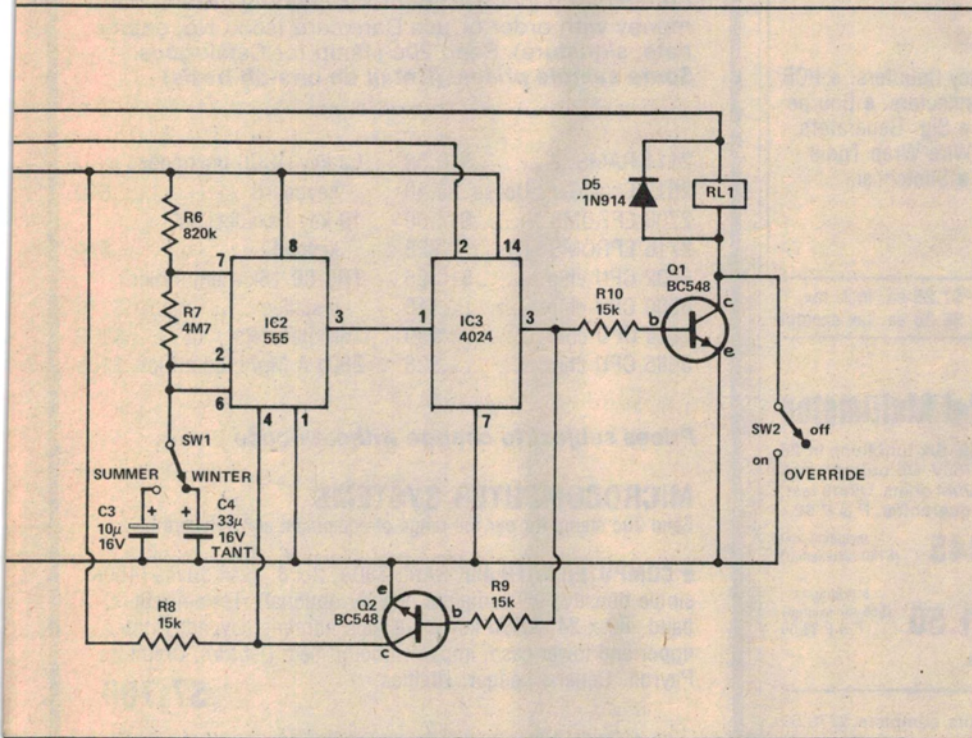
Construction

Construction should be relatively straightforward as there are no serious constraints on layout. If you elect to use the same box and transformer as we did the pc board is a tight fit, but the unit is compact and convenient. Be sure to earth the transformer clamp and the metal parts of the case, and keep the 240 volt wiring a safe distance from low voltage parts.

The first step is to place the major parts in position and mark and drill the mounting holes. Then, following the overlay, assemble the pcb, semiconductors last. Take care with the 4024 as it



An aquarium is undoubtedly a pretty sight in the home. But, some aspects of maintaining it are decidedly a chore. Jonathan Scott decided an electronic controller for his aquarium would make life just that much easier . . .



The circuit is flexible in operation, providing several options, uses readily-available components and is easily set up.

is a CMOS device. Next, wire up the unit as shown in the interconnection diagram leaving adequate lengths of wire between sections to allow convenient mounting.

Finally, fix all the major items in place, mounting the pc board off the case with 13 mm spacers.

Check that there is a high resistance between the transformer primary and secondary. A low resistance indicates a short somewhere. This is necessary to check that the mains wiring is correctly connected.



AQUARIUM LIGHT CONTROLLER

When the illumination on a light sensor exceeds a preset level, say at dawn, the lights are turned on. When the light falls below this level again, at sundown, a delay period is commenced, after which the lights are turned off. The delay can be switched to two convenient values for Summer (with Daylight Saving as well as longer days) or Winter, or the delay manually restarted when it is desired to keep the aquarium on show late into the evening.

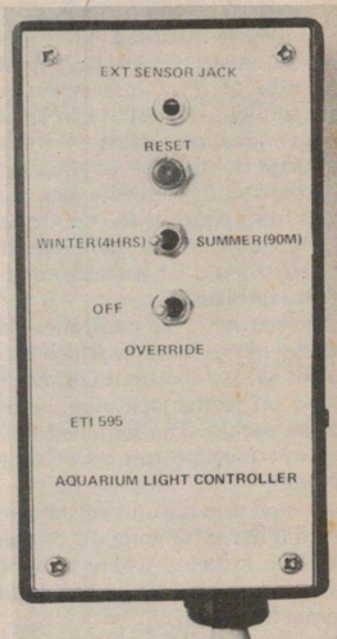
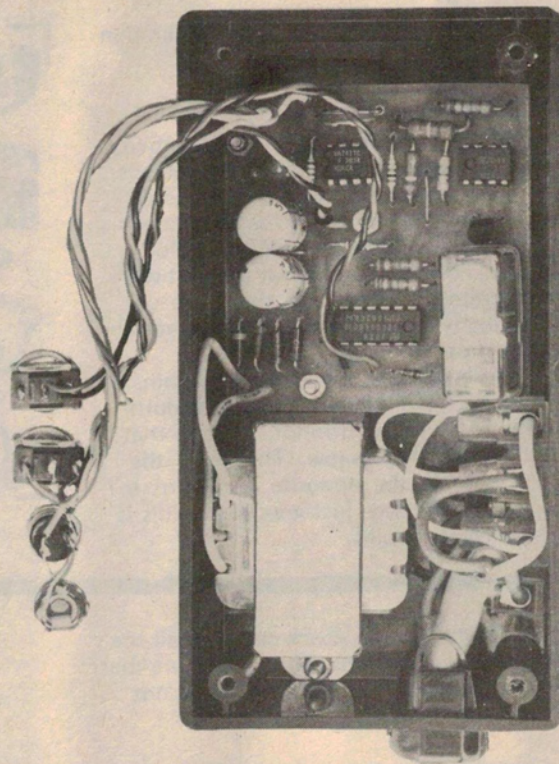
Initially, consider LDR1 to be well illuminated. Its resistance will be quite low; say 1-2k at most. The 741 is connected as a Schmidt trigger with a few percent hysteresis. In the illuminated condition its output holds the contents of the counter (4024) at zero via its reset line. The NE555 is connected as an astable multivibrator and oscillates with a period of 225 secs in winter and 85 secs in summer (approximately). The speed is defined by which capacitor is switched in circuit.

When the amount of light falling on the sensor drops sufficiently to cause the output of the 741 to go low the 555 begins to clock the counter. The counter is a seven-stage ripple counter and so the 64th pulse sets the seventh stage to "1". When this occurs the relay is pulled in and the light goes out. Simultaneously the reset line to the 555 is pulled low and it ceases oscillating. This is a stable condition, and the device remains inactive until the counter is again reset and the cycle recommenced. The reset switch momentarily resets the counter by tripping the Schmidt trigger which re-initiates the delay part of the cycle. The 'off' switch merely forces the relay on, holding the lights off, independent of the daily cycle. Hence, whenever it is released, the controller returns to the correct part of the cycle.

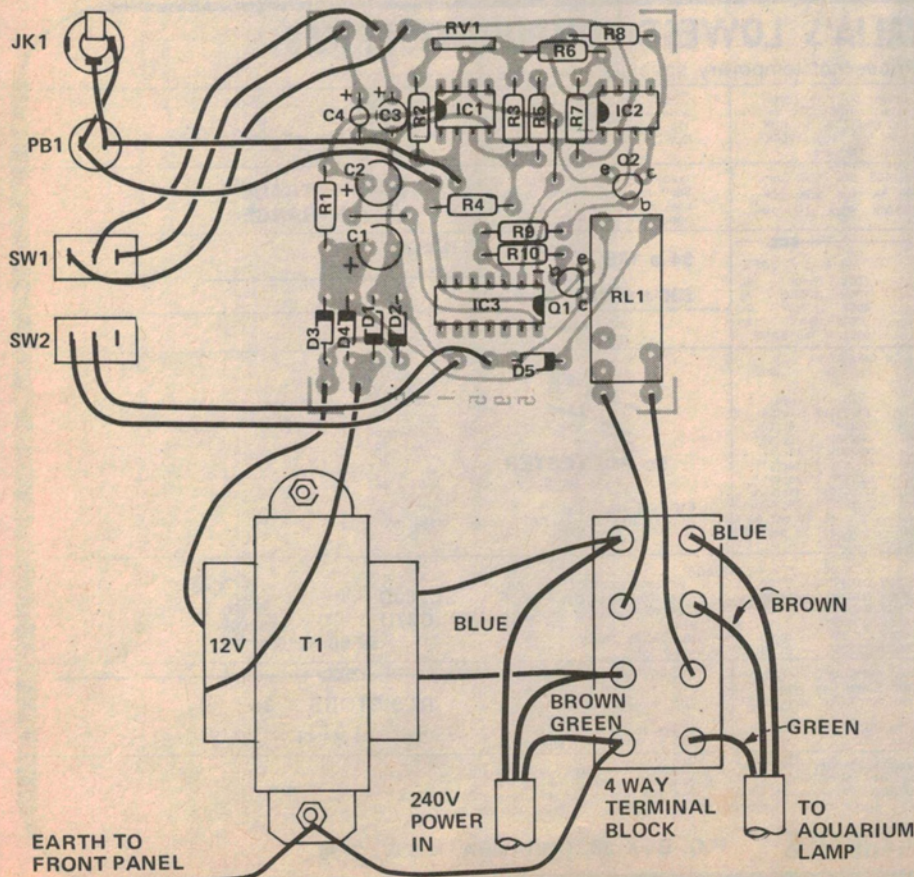
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The controller is constructed in a simple 'jiffy' box which can be placed in a convenient position. The light sensor may be mounted externally or on a jack plugged into the front panel.

Front panel view at right, internal view left.



Below: the pc overlay and wiring diagram. Take care with the 240 V wiring.



PARTS LIST - ETI 595

Resistors all 1/4W, 5%

R1	680R
R2	270R
R3, 4	10k
R5	39k
R6	820k
R7	4M7
R8, 9, 10	15k

Potentiometers

RV1	10k miniature vertical trimpot.
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Capacitors

C1, 2	100μ 25V electro
C3	10μ 25V tantalum
C4	33μ 16V tantalum

Semiconductors

D1-D4	EM401 or similar
D5	IN914
LDR1	ORP12 or similar
Q1, 2	BC548, DS548, BC108 or sim
IC1	741 8 pin miniclip
IC2	555
IC3	4024

Miscellaneous

RL1	miniature 12V single changeover relay 5 Amp pc mounting type.
SW1, 2	miniature SPDT toggle
PB1	miniature momentary pushbutton
P1	3.5 mm jack plug
JK 1	3.5 mm jack socket
T1	12 volt, 150 mA transformer

Plastic box to suit, 4 pin 240V plug, 3 pin 240V extension socket, length 240V 3 core cable, cable clamps, ETI 595 pcb.

AQUARIUM LAMP CONTROLLER

Installation

We have made provision in this project for a remote-mounted LDR light sensor as aquariums are usually placed in an area of the house away from direct sunlight. The LDR can be placed near a window or outside the house. A thin gauge twisted pair of wires can be run from the LDR to the jack socket on the front panel of the controller. If mounted outside the terminations of the LDR should be waterproofed with Araldite or Silastic.

Alternatively, the controller can be mounted near a window which receives sunlight all day and the LDR mounted directly on to the jack plug, inserted into the socket. The switched 240 V cable can then be run down to the aquarium.

In either case the unit will be sensitive to even quite small amounts of light and should be installed where it is not influenced unduly by normal house or external lights.

If you live in the vicinity of the Sydney Cricket Ground you may have to build a mask around the LDR sensor to prevent the (infamous) night

lights from the SCG upsetting operation of the unit!

Setting Up

Once the unit is installed the sensitivity to light level may be adjusted as follows:

First, you will need a multimeter. The best time to make the adjustment is early morning or dusk, on a cloudy day. This will ensure that the unit will operate correctly over the range of sunlight levels normally received at your location.

Measure the voltage between pins 4 and 6 of IC1 (the 741) with the multimeter. Turn the trimpot, RV1, so that the voltage goes low. Then turn the trimpot in the opposite direction so that the voltage just goes high. This is the correct point.

Remember to check carefully all the 240 V connections. This will ensure that the aquarium lamp lights up but not the fish!

