Signalite

APPLICATION NEWS

A DIVISION OF GENERAL INSTRUMENT

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MOTORLESS REMOTE CONTROL FOR COLOR TV

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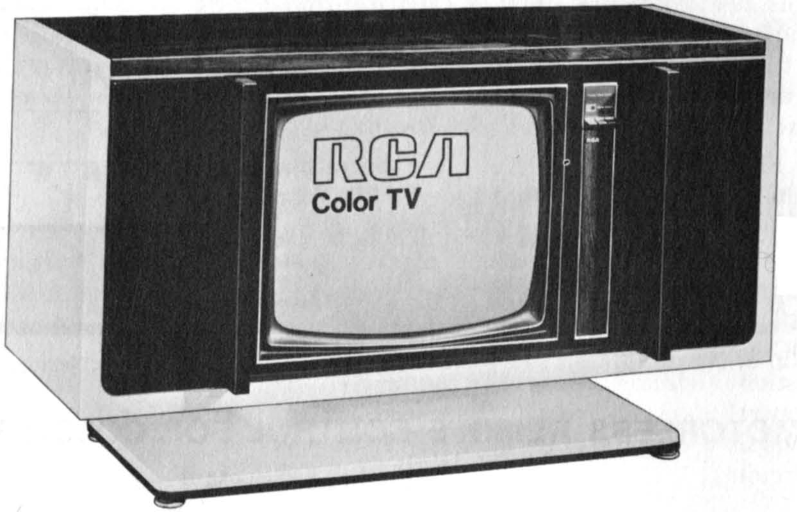
Color TV Engineering
RCA

The latest entry in the world of color television by RCA, the "Two Thousand", incorporates a number of technological advances in its all-solid-state chassis and an entirely new concept in control. This new control system is based on a non-mechanical design which provides all-electronic VHF channel selection, noise-free signal-seeking UHF tuning, and motorless remote control of the essential receiver functions.

Previously, the user was expected to control the various functions of the receiver, (channel selection, volume, color saturation, tint) by turning a shaft. In the case of remote control, these same shafts were turned by electric motors, which were controlled by relays and switches, and activated by the user manipulating the remote-control unit. Nevertheless, the basic system of control was mechanical.

In the "Two Thousand", VHF channel selection is accomplished by purely electrical means, there are no moving parts either for channel selection or fine tuning UHF tuning is accomplished by a motor-driven, non-detented gear train. UHF channel selection uses a signal-seeking system, the motor reverses at the limits of tuner-shaft rotation and automatically stops when a signal is received. Volume, color



saturation, and tint are controllable at the instrument by conventional controls; however, remote control of these functions is non-mechanical.

The remote transmitter is a 10-button device through which functional commands are sent to the remote-control amplifier in the instrument. Unlike conventional remotely controlled instruments, volume, tint, and color are controlled within the circuits by varying a voltage rather than a mechanically-adjustable resistor The local potentiometers are actually variable voltage sources. The nucleus of

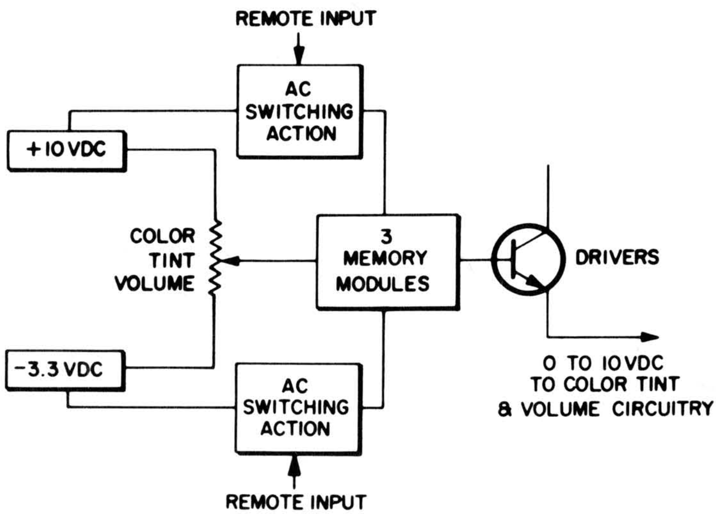


FIGURE 1
Block diagram of motorless control system

this new configuration is a capacitor-transistor-neon lamp "memory module", the output of which is a DC voltage which can vary from 0 to 10 volts in response to an input voltage determined by the remote transmitter There are three "memory modules" in the system, one each for volume, tint and color control.

Figure 1 illustrates the basic operating blocks of the motorless control system. A DC voltage variable from +10 volts to −3.3 volts is provided to the input of each of the memory modules via the respective color, tint, and volume manual controls. This DC voltage is supplied from two independent, regulated DC supplies, one operating at +10VDC and the other at −3.3VDC. The other path from these DC supplies to the input of the memory modules is provided by the action of electronic switches operated by the AC output of the remote control ultrasonic receiver preamplifier The 0-10VDC output of each module is coupled to a driver transistor which supplies the DC control circuitry

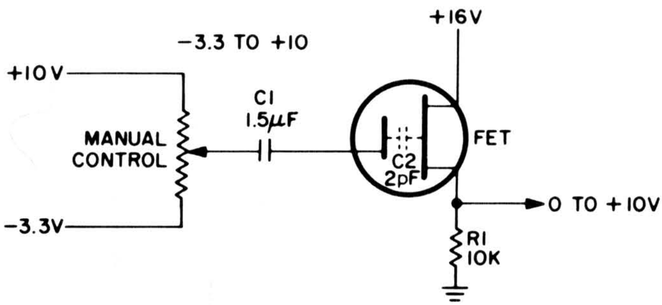


FIGURE 2
The FET in the memory module

Basically, the memory module utilizes a capacitive voltage divider consisting of the gate-channel capacity of a MOSFET and a 1.5-μF "memory" capacitor as shown in Figure 2. A DC voltage variable from −3.3VDC to +10VDC is applied to the capacitive divider consisting of capacitors C1 (1.5μF) and C2 (2pF). Capacitor C2 simulates the capacity between the gate and channel of a MOSFET Capacitor C1 is the "memory" capacitor Because of the capacitive divider action, the voltage set by the manual control becomes the MOSFET gate-to-channel voltage which controls the channel current. The output of the MOSFET circuit is coupled via a short-protecting resistor to the respective driver transistor

The means of applying a remotely actuated control voltage to the MOSFET in the module is shown in Figure 3. A path for the DC control voltage to charge capacitor C1 is provided by the ionization of Signalite's neon lamp, A287 (DS1 and DS2). The lamp is ionized by a 225V peak to peak (nominal) AC voltage from the ultrasonic receiver amplifier. The

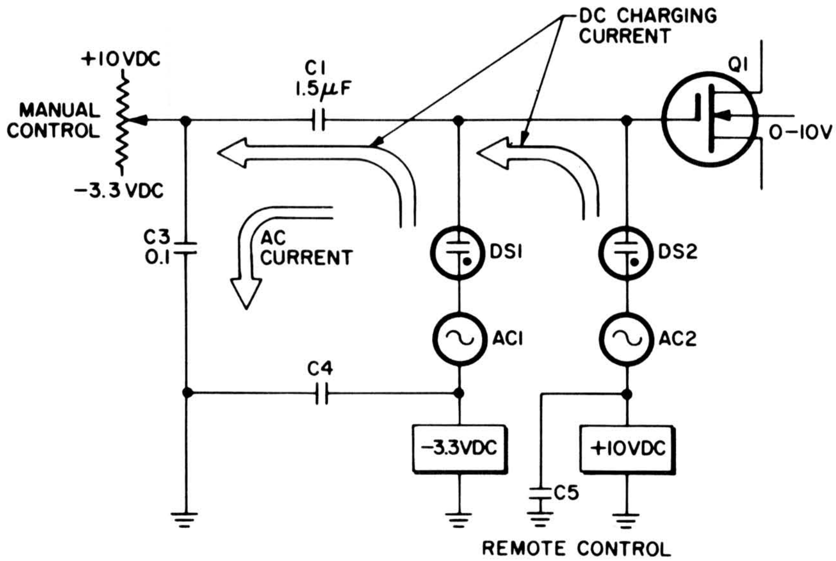


FIGURE 3
Memory Module

charging time constant consisting of C1 and the impedance of the DC supply is approximately six seconds. Thus, the voltage on C1, and therefore the gate voltage of the MOSFET, is proportional to the length of time the AC switching voltage is present. When the AC switching voltage is removed, the extremely high impedance offered by the neon lamp and the MOSFET allows the charge to remain on the capacitor Thus the capacitor "remembers" the charge present when the AC switching voltage is removed. Capacitors C3, C4 and C5 complete the AC path for the AC switching voltage.

Two neon lamp "switches" are required for each module—one to provide charging from the −3.3VDC supply and the other to provide charging from the +10VDC supply This allows the MOSFET to supply the full range of output control voltage (0 to 10VDC).

Two characteristics are extremely important in the neon lamp as used in this application. First, in order for the memory circuit to remember for long periods of time, its leakage resistance must be very high. The A287 has a leakage resistance greater than 10^{12} ohms, and when used in conjunction with a MOSFET (with a leakage resistance of 10^{13} ohms), circuit leakage will be less than 5% in 1000 hours. The second requirement is that the neon lamp be symmetrical in its maintaining voltage for both the positive and negative AC cycles. The A287 is symmetrical within ± 0.7 volts.

The complete action of the AC switching circuitry can be exemplified by referring to Figure 4. A "down" command from the remote control circuitry produces a 225V-PP AC switching voltage, AC1, which ionizes neon lamp DS1. This neon lamp will ionize upon the application of a 100V peak voltage. Thus ionization, and therefore DC charging current flow, will take place during each half-cycle of the AC switching voltage. Capacitor C1 will charge from the +10VDC supply, producing a final voltage proportional to the length of time the switching voltage is present.

An "up" command from the remote control circuitry produces an AC switching voltage of a slightly different frequency (AC2). Frequency selective circuitry will result in the ionization of neon DS2. Capacitor C1 will then charge from the —3.3VDC supply The net charge on the

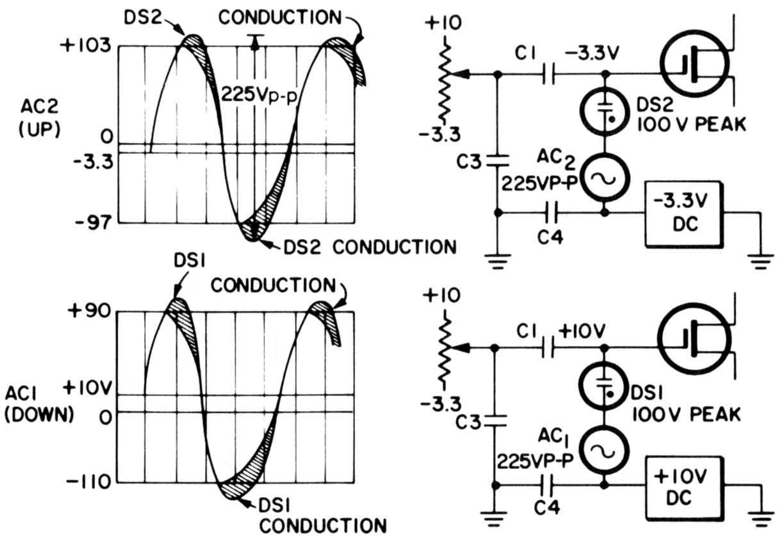


FIGURE 4
Neon conduction AC (remote) circuit

capacitor will be a function of the original charge and the length of charge time from the —3.3V supply

A complete schematic of the modular MOSFET circuit with both 'manual" and remote circuits is shown in Figure 5. The addition of switch K1 provides a means to discharge capacitor C1 when it is desired to control the module with the manual control. Switch K1 represents the contacts of a normally open reed relay. This relay is actuated by a normally open "delta" switch mechanically coupled to each manual control (color, tint and volume). The rotation of the

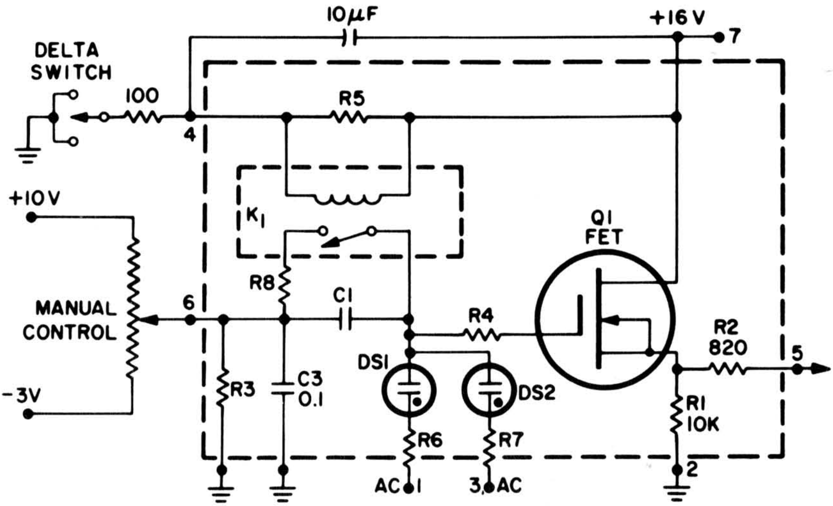


FIGURE 5
Remote control "Memory Module"

control in either direction results in closure of K1, discharging the capacitor C1 and "resetting" the MOSFET input voltage to that set by the control. All three modules are identical and interchangeable. The 10- F capacitor across the relay control coil reduces the rate of collapse of the coil field. The 100 ohm resistor in series with the delta switch eliminates surge currents through the switch contacts. If the module should be removed while power is being supplied, resistor R5 will dampen any excessive voltage developed by the collapsing field about the control coil of K1.

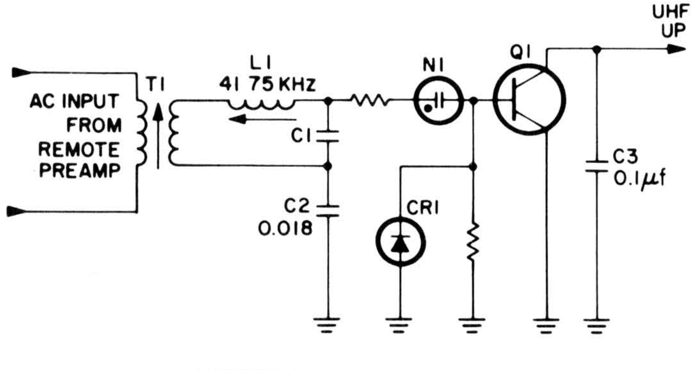


FIGURE 6
UHF "up" remote control keyer

Resistor R3 acts as a discharge path for capacitor C3, protecting the MOSFET if the module is removed from the circuit board. Resistors R6 and R7 limit the AC switching current through the A287 neon lamps.

In addition to the remote control of the color, tint, and volume controls, remote actuation of the VHF and UHF tuner-control logic circuits and of the power on-off bistable relay is accomplished using neon lamps. All of the keyer circuits operate in a similar manner except, of course, the keying frequencies are different. A representative keying circuit—The UHF "up" keyer— is illustrated in Figure 6. AC energy from the remote preamplifier is applied to keying circuit via T1. A series resonant circuit consisting of L1 and C1 provides a voltage across C1 of sufficient amplitude to ionize the neon lamp N1 This provides a threshold of sensitivity and thereby a degree of noise immunity. Diode CR1 protects the base-emitter junction of Q1 from reverse voltage breakdown. The positive-going cycles of the AC energy bias transistor Q1 into saturation, effectively grounding the up command input to the UHF logic circuitry This action starts the UHF motor searching in an up direction.

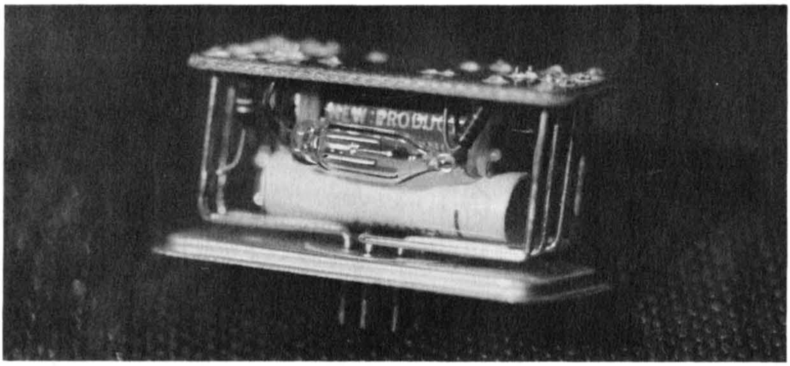


FIGURE 7
Memory module with cover removed

This newest advance in television control rapid, quiet and motorless remote control—coupled with the high performance of all-solid-state circuitry, increased reliability through the elimination of all vacuum tubes and all but one motor, bring color television one step closer to the long-sought goal of perfection in color television as effortless and thoroughly enjoyable entertainment.

A portion of this material was adapted from the book "The Two Thousand Technical Manual," courtesy RCA Sales Corporation.

YOUR GLOW LAMP APPLICATION FORUM

It is Signalite's policy to publish letters based on their intrinsic interest only. We do not necessarily agree with all comments and suggested uses and will upon occasion wait for your reaction before taking editorial space for ours.

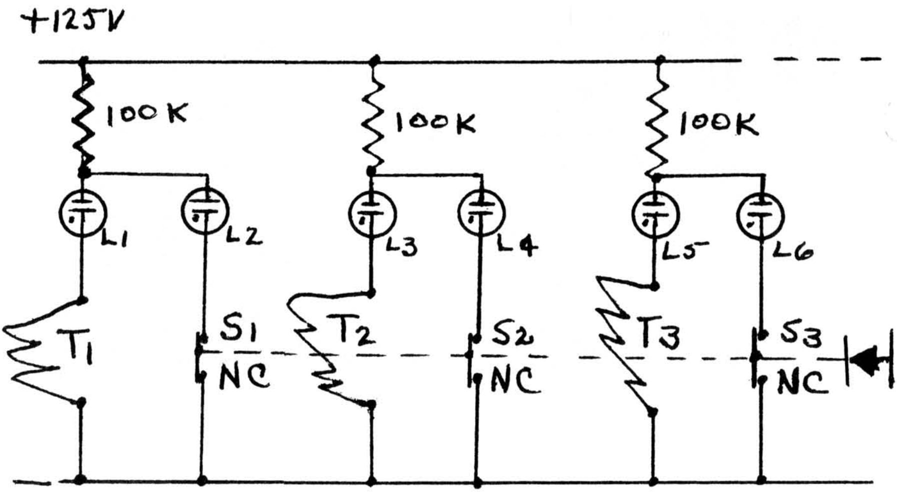
MONITOR CONDUCTORS IN HARNESS

Gentlemen

This device was originally put together to monitor many conductors in a wiring harness during vibration and to detect and indicate any opens or intermittent connections.

T1, T2, T3, etc. are circuits to be tested.

After all circuits to be tested are connected and power is applied, the normally closed switches are opened momentarily The even numbered lamps will extinguish and the odd numbered lamps will light.



If any of the circuits under test open even momentarily, the odd numbered lamp will extinguish and the even number will illuminate. This device has been used to test as many as 200 circuits at one time. It is inexpensive and positive.

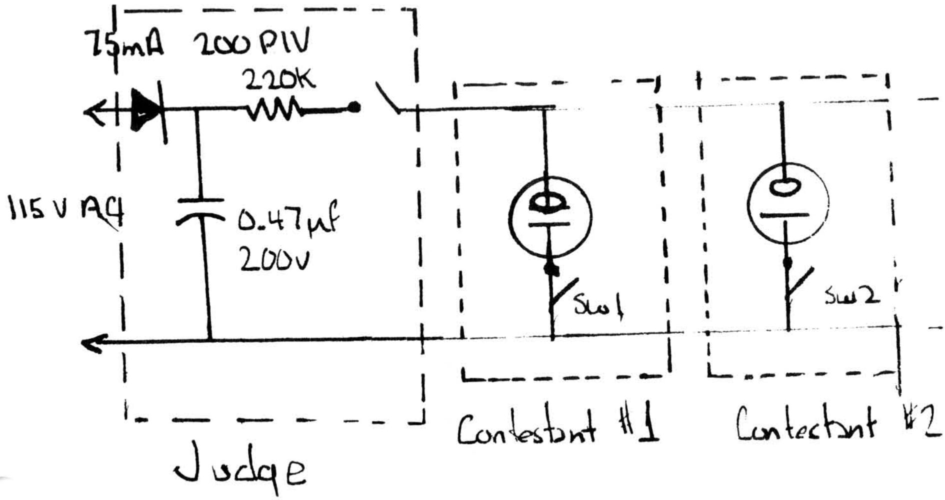
Sincerely,

Ray Harland
Escondido, Calif

GAMES THAT PEOPLE PLAY

Gentlemen

Here is a circuit for any question-and-answer party game (such as TV's "Jeopardy"). The first button pushed ionizes the neon light, drop-



ping the DC voltage on the parallel neons (the other contestants) below the ionization level determining unequivocally the first person to think of the right answer

Sincerely,

Milo Sampson
Indiana Univ School of Medicine

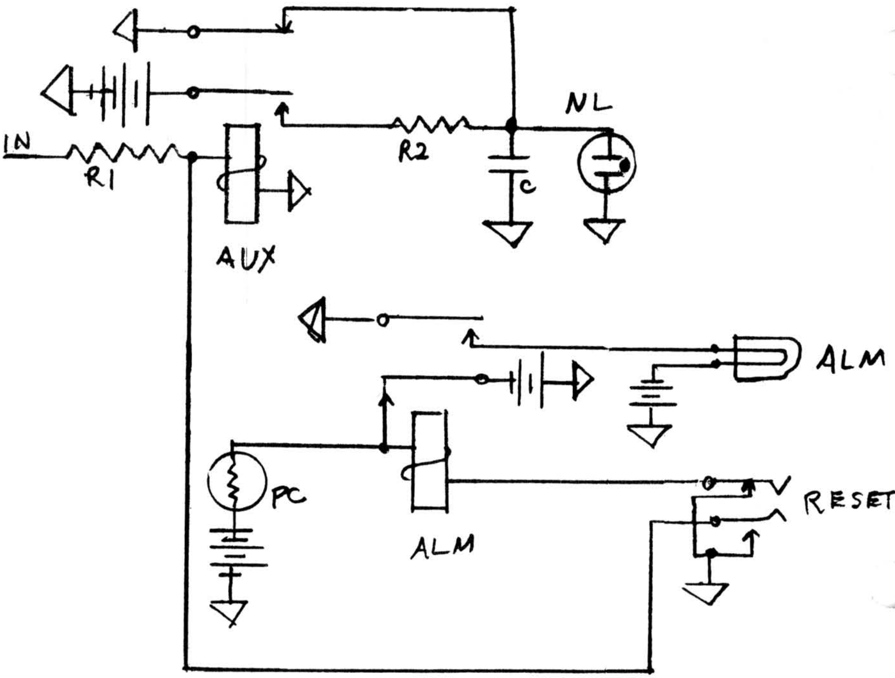
ALARM DELAY CIRCUIT

Dear Sirs.

(Below) is a suggested use of a neon glow lamp and photo cell to provide an alarm delay circuit such as used to alarm a communications channel for lack of sufficient signal strength. The time delay required is of course dependent upon the length of hit or fade that can be tolerated.

The neon glow lamp and photo cell combination is more economical than thermal relays, mechanical timers, thyratrons, or other devices previously used.

Voltage on lead "IN" operates "AUX" relay "AUX" relay operated places battery through resistance R2 to fire neon glow lamp NL. The time delay in firing of NL is determined by the values of R2 and C. Upon



firing of NL the photo cell PC reduces resistance causing relay ALM to operate. Relay ALM locks through its own make contact and a back contact of RESET key Operation of relay ALM also lights the ALM lamp. To reset the circuit and to determine if the alarm condition continues to exist the RESET key is operated which opens the hold path for the ALM relay and shorts out the AUX relay A back contact on the AUX relay discharges C preventing operation as a result of a series of short alarm hits or a shortened time out for legitimate alarm following a short hit.

Frank Schwender, Senior Engineer

Western Electric

DOUBLE DUTY FROM FLASHER INDICATOR

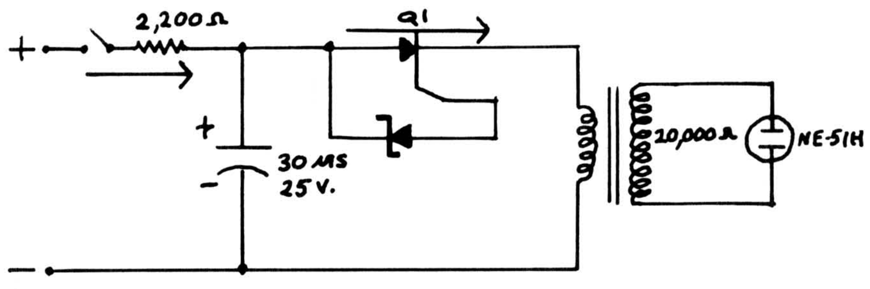
Gentlemen

Recently, I built a solid state preselector for my communications receiver which already had a tuned RF stage. The circuit uses Field Effect Transistors for high gain and the results were fantastic However, the preselector chassis has other devices on it and the rotary power switch controls four circuits.

The power is supplied by two 9 volt transistor radio batteries, which eliminates the noise I could get from the 60Hz Power line. After a few days, I became careless and would leave the preselector on after the receiver was turned off Also, maybe I am old fashioned, but after 35 years in electronics I still want to see a pilot light come on when I turn on a switch. Due to the current drain, an incandescent pilot light was out of the question.

To provide a low current type pilot light this circuit was developed and installed on the chassis. The neon bulb flashes approximately four times per second

Here is how it works the 30 mfd condenser slowly charges thru the 2.200 ohm resistor When its voltage reaches 15 volts, the zener diode (Q2) conducts and fires the SCR (Q1) thereby discharging the condenser thru the transformer (T1) causing the neon bulb to flash



The back EMF from T1 then causes Q1 to stop conducting and the procedure is then repeated. Faster flash rates may be obtained by decreasing the value of the resistance and/or the capacitor and slower flash rates by increasing these values.

After using this flasher a few weeks, I realized that it also was a low voltage indicator When the lamp does not flash, the battery voltage had dropped below 15 volts, so, to realize the maximum gain from the preamplifier I know it is time to replace the batteries.

And, I do enjoy seeing something positive happen when the preselector is turned on.

Sincerely yours,

Robert E. Cundiff
Fountain Valley, California

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* * * * *

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