Signalite

APPLICATION NEWS

from the desk of

Ed Bauman, Chief Engineer

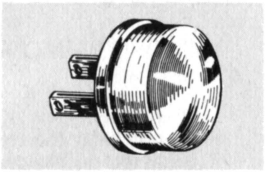
VOL. 2, NO. 2.

Send Us Your Glow Lamp Application

The use of the neon glow lamp as a reliable circuit component has dramatically increased the need for application information. We are asking that you:

1) Send application examples—both general and specific

2) Send application problems or solutions to problems that we publish



A Signalite Owl Eye Nite Lite for the home will be sent free to each person who sends us an application, a problem or a solution.

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SOME USES FOR NEON-PHOTOCELL UNITS

By: D. Whateley
Applications Engineering Laboratory
Raytheon Company, Lexington, Mass.

An interesting variety of applications are being developed for electro-optical components which consist of a neon glow lamp assembled in a light-tight casing with a photoconductive device. Because of the advantages of economy, long life, low maintenance and low noise, this type of unit is finding increasing use in electronic circuitry as a switch and as a variable resistance.

The light output and spectral distribution of certain neon glow lamps are compatible with photosensitive polycrystalline semi-conductors such as cadmium selenide and cadmium sulphide. For many applications the low power consumption and speed of response of a neon glow lamp makes it the ideal light source for use with the photocell.

Basically, these devices operate on the principle that any variation of the input current to the neon lamp alters the illumination incident on the photocell and

changes its resistance. As a result the voltage across a fixed resistance in series with a signal voltage and the photocell can be changed by altering the input current to the light source.

Photocells have two response speeds which govern their application, their turn-on response and their turn-off response. In the neon lamp-photocell devices, the speed of response is limited to that of the photocell since the glow lamps are capable of faster reaction times than the photocells.

Among the Raysistors®, developed and produced by Raytheon Company, are neon glow lamp-photocell combinations which are designed to be used as a single component to perform a specific function. Working closely with Signalite, three primary requirements for performance of the glow lamps were established. Because the Raysistor is a closed, encapsulated unit, the lamp had to fire reliably in a dark environment. For practical usage, a high ratio of conversion of current to light was required. And because replacement of parts in the Raysistor was not compatible with its design purpose, the lamps must have a long effective life.

The special lamp developed by Signalite engineers, type A240954, was based on use of some of the recent technological developments in the design of gas discharge devices. Among these are included special radioactive elements, new gas mixtures, electrode design, and others. These developments have made it possible to establish new standards for neon glow lamps for use as electronic circuit components, standards which are not based on adapting indicator lamps to performance for which they are not suited.

CHOPPERS-MODULATORS

Choppers or modulators using photoconducting cells and modulated light sources offer the equipment designer several unique advantages. The purely ohmic behavior of the photoconducting cell, and the ease with which the cell may be shielded from induced emf's at the chopping frequency tend to eliminate the more common sources of null offset. Contact malfunctions are eliminated entirely. Since there is no voltage present at the cell except that due to the dc source being measured, there is no critical balance to be upset as in the case of solid state devices using barrier junctions.

As a series modulator (Figure 1) at low chopping frequencies from 30 to 60 cps the output waveform is nearly squarewave so that the results are comparable to other types of choppers. At higher frequencies the output waveform becomes more nearly sinusoidal and it becomes necessary to consider amplifier and detector characteristics before comparing relative efficiencies.

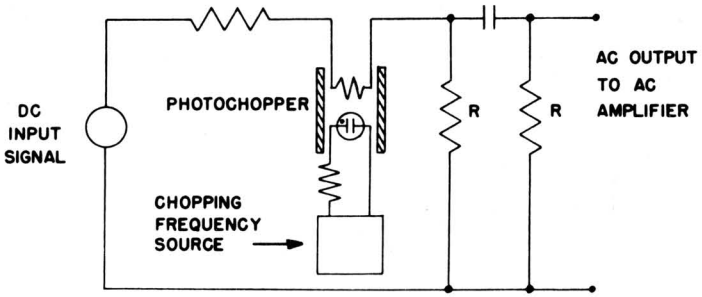


FIGURE 1 SERIES MODULATOR

The series shunt circuit (Figure 2) provides a more symmetrical waveform and may result in less drift in null offset under varying environmental conditions. The photochoppers must be operated 180 degrees out of phase. Although there may be up to 6 db advantages in this circuit at higher frequencies, at low frequencies the use of the simple series circuit may be more economical.

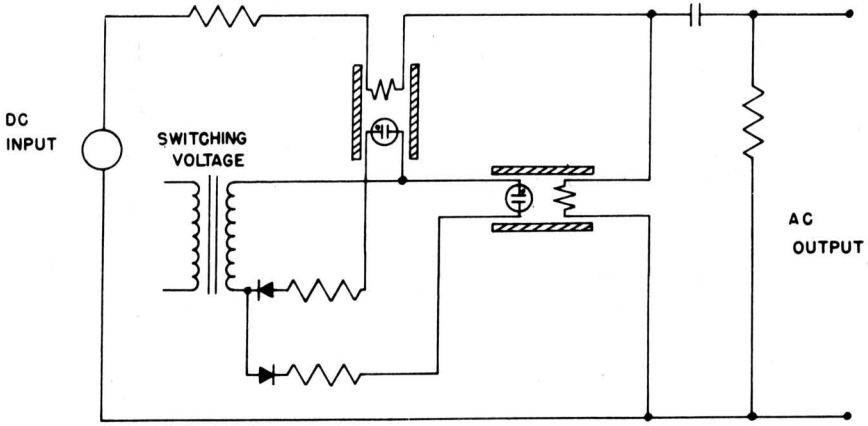
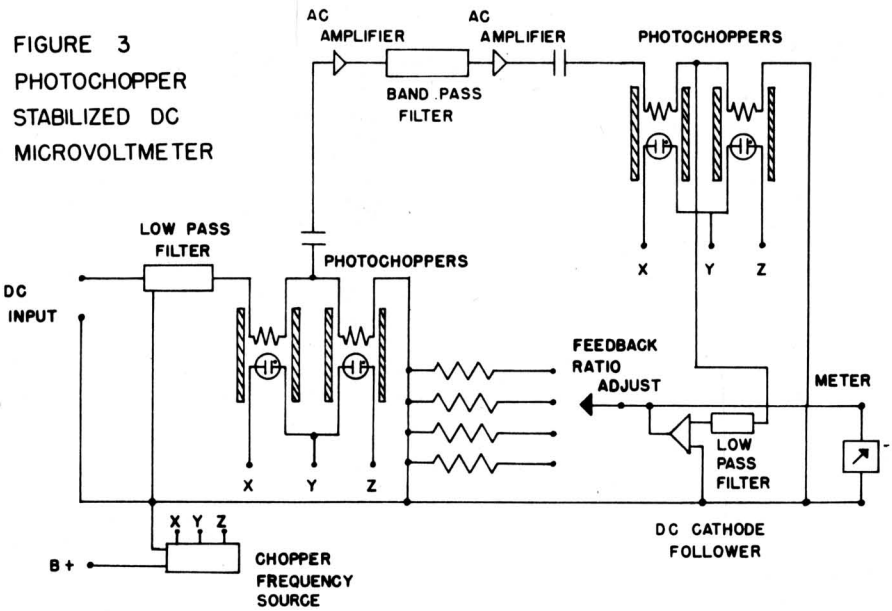


FIGURE 2 SERIES SHUNT MODULATOR

For the ultimate in low drift or minimum null offset in DC amplifiers, the photochoppers can be used for both the modulator and demodulator. This is accomplished by the constant phase relationship between modulator and demodulator, shown in Figure 3.



POWER SUPPLIES

Another example of using the Raysistor as a photochopper is in a regulated power supply as shown in Figure 4. In this application the error voltage is fed through a chopper, an ac amplifier, a diode demodulator, and then back to control its own chopper frequency. It can be seen that with the judicious choice of ac amplifier gain and dc amplifier gain, this can regulate output voltages to very close tolerances.

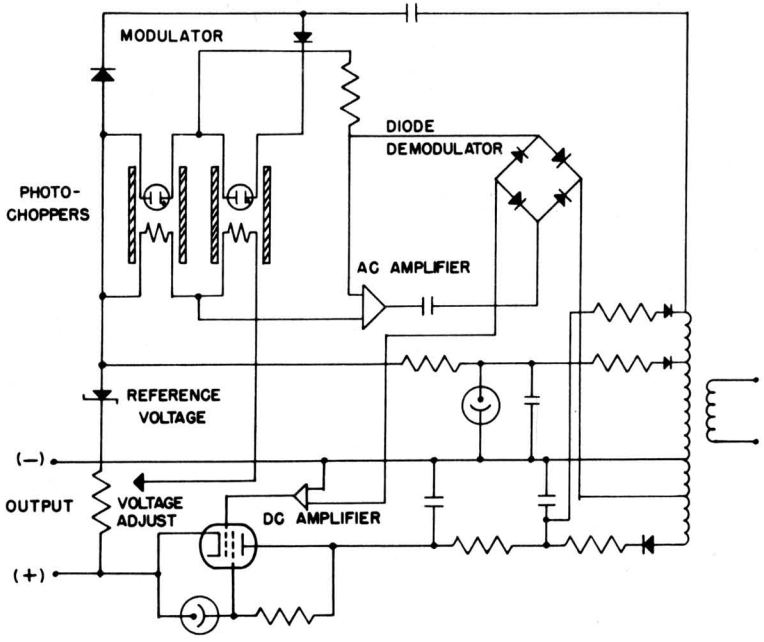


FIGURE 4 PHOTOCHOPPER STABILIZED POWER SUPPLY

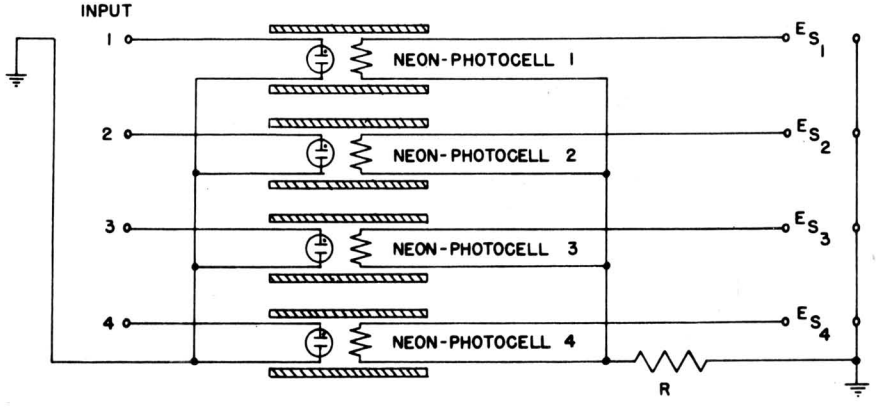


FIGURE 5 SWITCHING ELEMENT FOR LOW LEVEL SIGNALS

LOW NOISE SWITCH

The glow lamp-photocell combination will provide a low noise switch, free of transients or pedestals, for switching low level signals. It is a relatively slow speed device. The "off" time is normally slower than the "on" time, and it is the "off" time that determines the maximum switching rate. Any number of devices can be switched in succession provided a means of sequentially switching the control circuits is provided. Figure 5

A two-photocell sequential switch circuit using a self-excited multivibrator is shown in Figure 6.

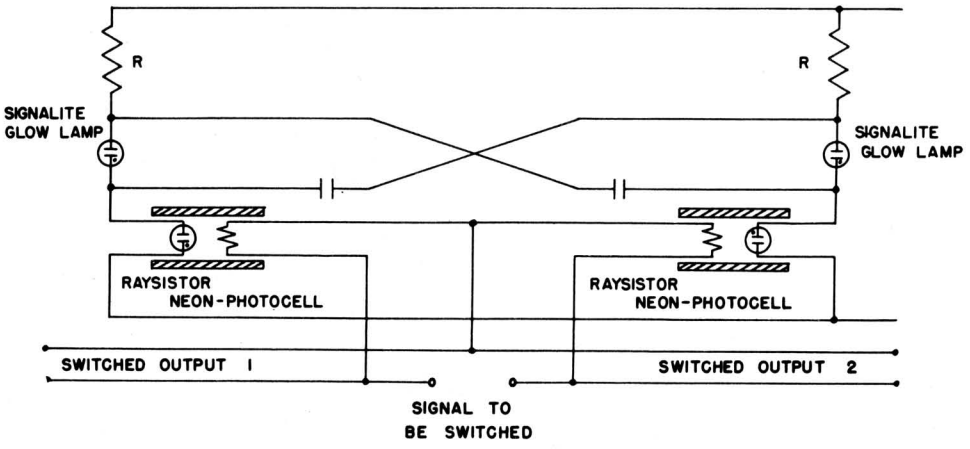


FIGURE 6 SEQUENTIAL SWITCH WITH MULTIVIBRATOR CIRCUIT

OVERLOAD PROTECTION

Use of the glow lamp-photocell to provide high voltage overload protection is shown in Figure 7. Any arc or intermittent short circuit in the tube will cause an increase in the average current through the neon glow lamp and reduce the photocell resistance. The relay is activated and opens the circuit, preventing damage to the circuit components. As shown, the response time of the unit is quite rapid since there is a current through the lamp circuit continuously.

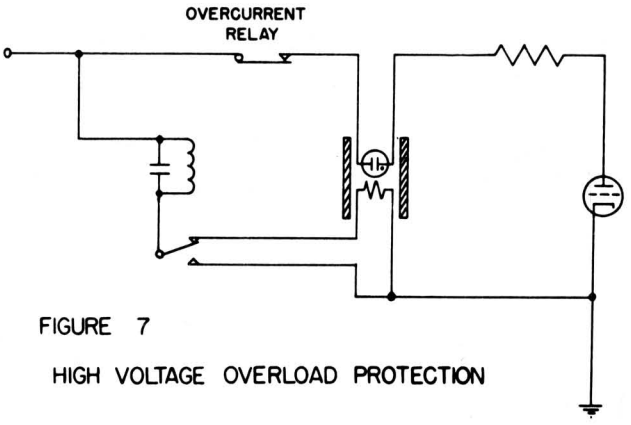


FIGURE 7

HIGH VOLTAGE OVERLOAD PROTECTION

MEMORY CIRCUITS

Memory circuits such as the one shown in Figure 8 can utilize the neon glow lamp-photocell device. With the glow lamp non-conducting the resistance of the photocell is very large and any input dc will be attenuated by the photoconductor by a large factor. However, if the glow lamp is triggered on, the light from the glow lamp will cause the resistance of the photocell to decrease to a low value depending on the characteristics of the photocell and the lamp used. The input dc will now appear at the output attenuated only by the low resistance of the illuminated photoconductor.

Electro-optical switches and variable resistors such as the Raysistor offer special advantages in that they are free of the maintenance problems of mechanical switches, they are insensitive to shock and vibration, free from contact bounce or jitter, and have an inherently long life. Availability of neon glow lamps to extremely precise parameters is making this component even more valuable to the design engineer.

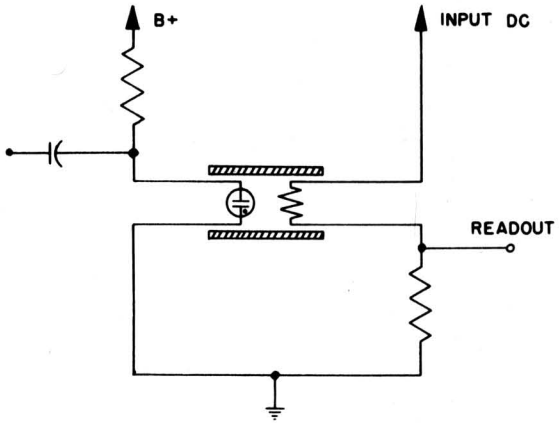


FIGURE 8 SIMPLE MEMORY CIRCUIT

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Congratulations to Mr. J. La Fiandra and Mr. H. Jennings of Edo Corporation for their article Photoconductive Selector Circuit Uses Neon Glow Lamps *which appeared in the January, 1964 issue of Electro-Technology magazine. The complete article also appeared in Signalite Application News, Vol. 2 No. 1.*

*

Tighter Specs For Neons

PROGRESS IN COMPONENTS

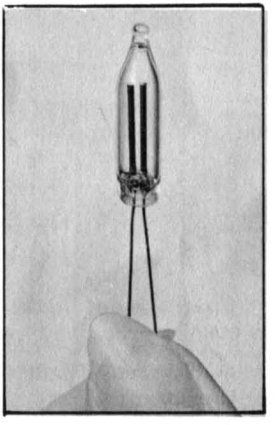
Though neon glow lamps are intended solely for indication or illumination, most of us have used them for other applications — with varying success. We've used them as sawtooth oscillators, as voltage regulators, as coupling elements, as contact protectors, and in a host of other applications where their low price, small size, tiny power drain, and obvious indication of being "on," provided a powerful attraction.

In the past, however, they could never be used in anything bordering a "tight-spec" application. Their critical parameters — firing voltage and maintaining voltage—wouldn't hold still. For those touchy applications, some equipment manufacturers would age neons to eliminate drift, then select those with suitable characteristics. This can be a time-consuming and costly proposition.

At last the problem has been licked — at least in part. Signalite, Inc., of Neptune, N. J., now offers neons with controlled firing voltage or maintaining voltage. Both can be controlled in the same lamp, but not as an off-the-shelf product.

An example is the Signalite AO-59, whose maintaining voltage can be held within ± 1 volt for any maintaining voltage between 52 and 59 vdc. Earlier equivalents, for the 50 to 60 v range, were specified at 55 ± 5 v. Design current for the AO-59 is 0.3 ma and firing voltage is 65 to 75 vdc. At 0.3 ma, the lamp has a rated life of 7500 hours of continuous operation.

Firing voltages are somewhat tougher to control, but they can now be held to within ± 1.5 vdc.



Reprinted from January, 1964, issue of EEE — the magazine of CIRCUIT DESIGN ENGINEERING

OWL EYE NITE LITE RECEIVES NATIONAL PROMINENCE ON MAGGIE McNELLIS SHOW

Mr. Richard Neygro, public relations consultant for Signalite Inc., Neptune, N. J., discusses Signalite's Owl Nite Lite with Maggie McNellis on the **At Your Request** radio interview show.

Miss McNellis' program is heard daily on 360 AM and FM stations across the nation.

ANSWER TO: CAN YOU SOLVE THIS?

NEED FREQUENCY DIVIDER

Dear Sir:

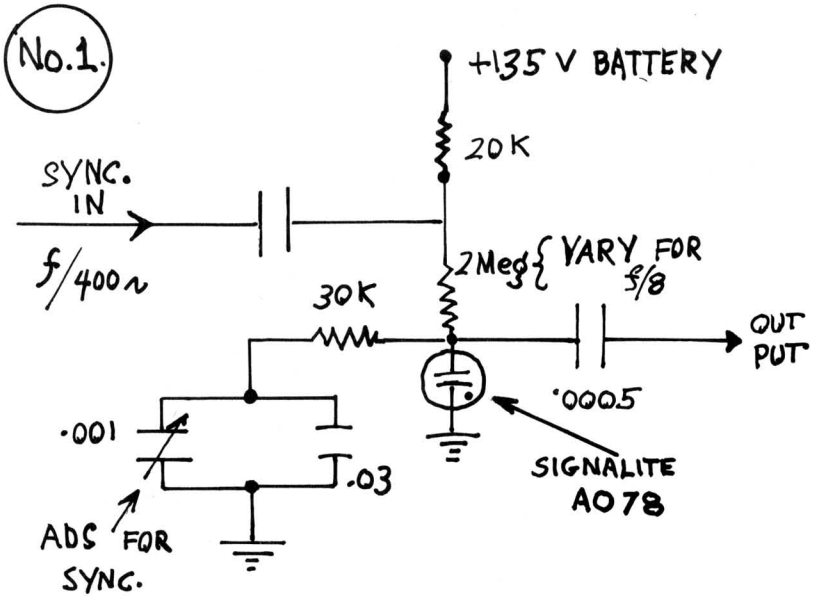
In reference to the request of Mr. Laurence G. Cowles of Superior Oil Co. in your Signalite Application News for Vol. 2, No. 1 "Need Frequency Divider":

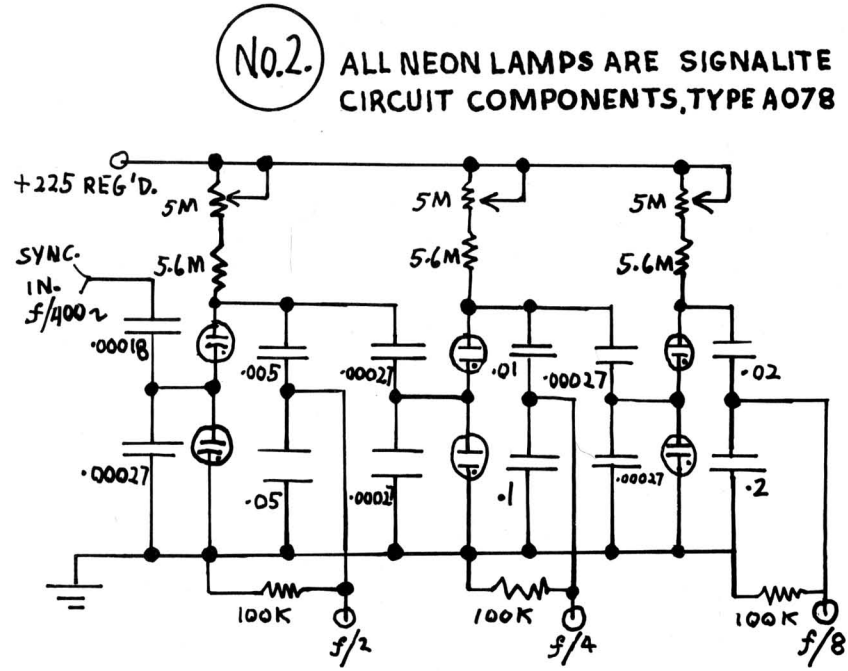
Enclosed are some rough sketches of some types of neon relaxation oscillators as used in electronic organs.

No. 1 is a single stage synchronized type; No. 2 is a frequency divider type.

It is possible to use only one stage of type No. 2, but the stability would not be as good as when used in a chain of dividers.

Joseph J. Ruk
Pacific Tel. & Tel. Co.





Ed Note:

Since the 400 cycle input and division by eight (or 50 cycle output) is fixed, we feel that Mr. Ruk's first solution is the most satisfactory answer because of its basic simplicity. No. 2 is a popular circuit used widely in electronic organs and test equipment.

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.

LEAKAGE CHECKER

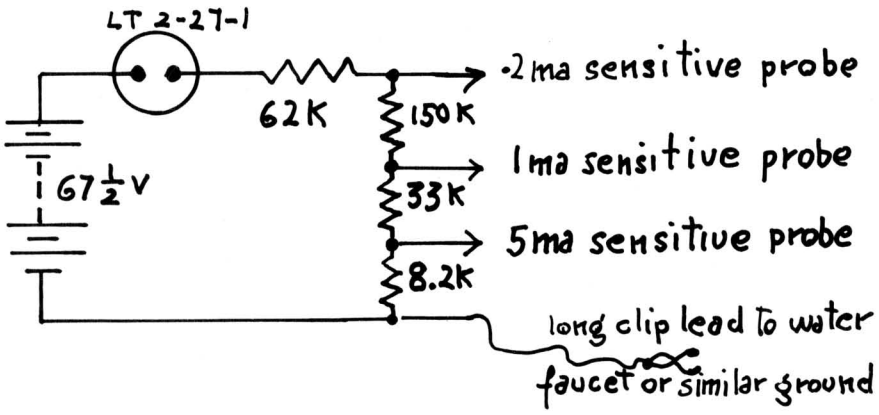
Dear Mr. Bauman:

This circuit is what I call an "Appliance Leakage Checker". This device detects any part of an appliance or machine which would allow current to flow thru a person touching it and ground at the same time. Electric toasters for instance frequently allow a small current to flow if a person touches the metal case and the kitchen sink. Current is detected because the insulation leakages involved are usually very small approximating a constant current source. Part of the idea and the ratings come from Consumers Union. Safety ratings are:

less than 0.1 ma rms	— acceptable
less than 1 ma rms	— slight shock
less than 5 ma	— border line
greater than 5 ma	— NOT acceptable (this could be dangerous and above "let go" current)

The actual prototype unit was cast in an epoxy block with the long ground lead and 3 pointed probes coming out one end. The bulb which tested at 84 vac breakdown voltage was set half way into the top surface of the device. In use the ground wire is clipped to a convenient point and devices such as machine tools, toasters, washers, mixers, electric drills, wiring, conduit, etc. are touched with the various probes.

Peter Lefferts
Sr. Design Engineer
Carter-Princeton

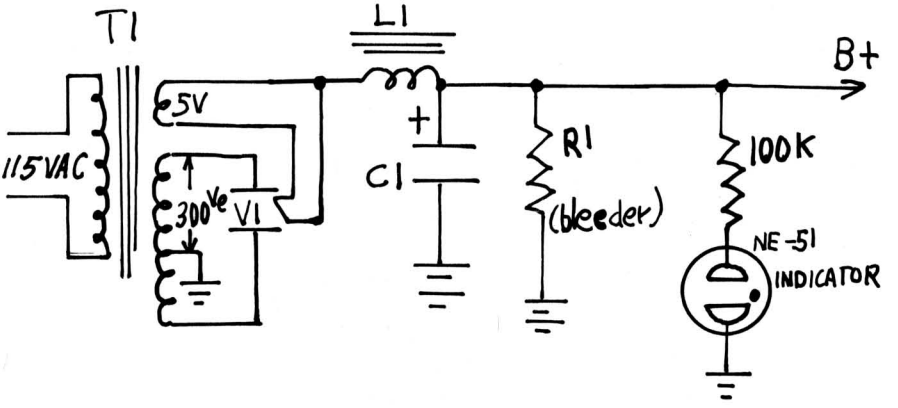


B+ VOLTAGE INDICATOR

Dear Sir:

A safety application of neon glow lamps is their use as a B+ voltage indicator. In the representative power supply schematic shown here, a glowing neon lamp indicates the presence of a charge stored in C1 due to failure of the bleeder resistor, R1, also gradually bleeding off this charge. In trouble shooting equipment associated with this supply, the indicator not glowing would immediately point out the absence of B+, indicating trouble in T1, V1, L1, or associated circuitry or wiring.

Al Millman
RCA



Ed Note:

You may also want to put an indicator lamp on primary of transformer to indicate presence of primary voltage. Use of our LNE-51 with a 47 K resistor would give a greater light output in this application.

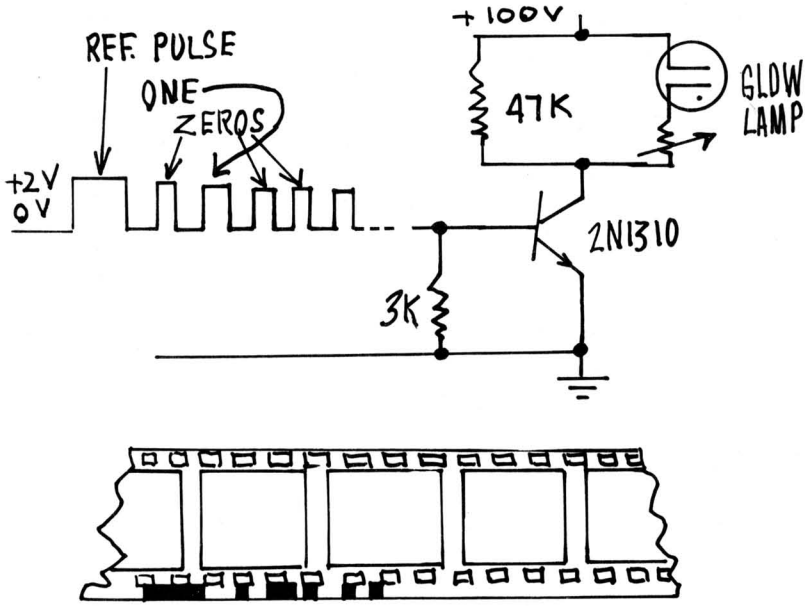
*

FILM MARKER

Gentlemen:

The requirement existed to mark 35 mm instrumentation film with time information. I used the available binary time code and a transistor driven glow lamp to satisfy the requirement. The glow lamp was placed in a rig inside the camera such that the edge of the film was exposed through a pin size hole. Higher camera frame rates dictate the use of a brighter lamp.

Ray E. Lawson
Edgerton, Germeshausen & Grier, Inc.



Ed Note:

Use of our AO 79 will allow reduction of B+ voltage to 75 with the same light output. Use a 56 K ½ w resistor in series with this lamp. Specs are: Breakdown voltage 70 vdc max, design current 0.3 ma, maintaining voltage 58 vdc max, light output is standard.

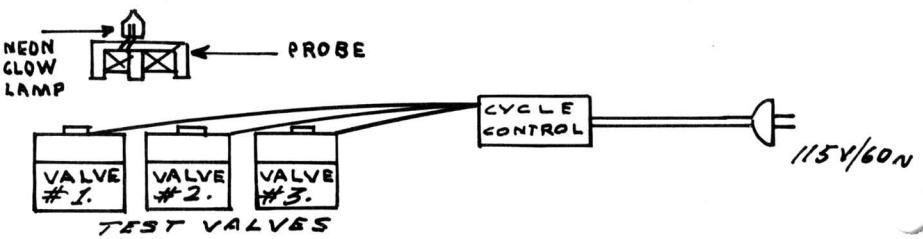
*

LOCATING AN AC MAGNETIC FIELD

Gentlemen:

We have found that a solenoid coil with a partial magnetic circuit, connected across a glow lamp, makes a handy probe to quickly indicate coil function or failure in large groups of solenoid valves.

Robert Weinberg
Electrical Engineer
Skinner Precision Industries, Inc.



Ed Note:

While this is a specific application, we note that there are many other places where this approach would be applicable to determine whether an AC magnetic field exists.

SAW TOOTH OSCILLATOR

Dear Mr. Bauman:

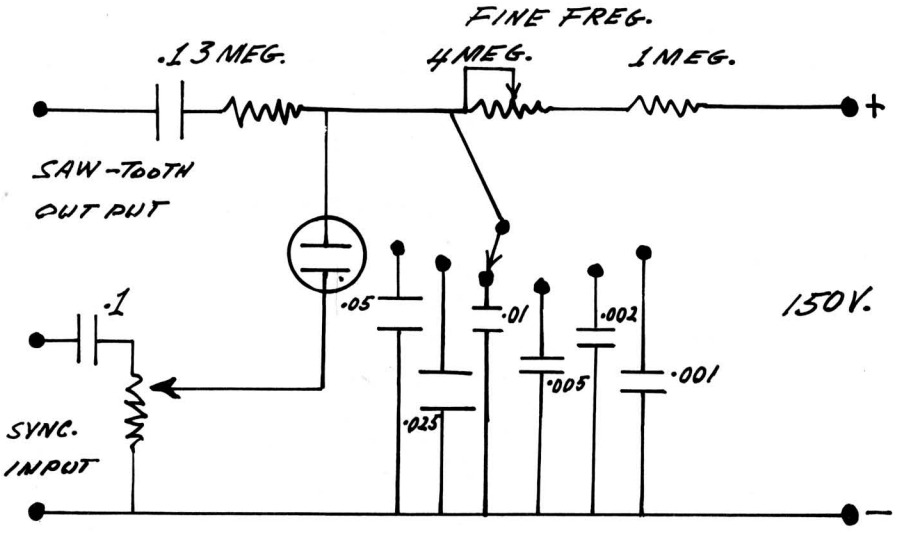
Enclosed is a circuit diagram of a saw tooth oscillator, using a neon glow lamp. I have had this instrument in use for some time as a source of saw tooth voltage for horizontal sweep of a small oscilloscope. With the components given, the frequency range is from about 5 cps to over 1500 cps, which is well suited for the small oscilloscope.

There are many versions of this circuit that could be used and the parts are not critical. Changing the resistance or the capacitance would of course, change the oscillator frequency.

If only a small range of frequency is to be covered, a single capacitor could be used across the neon bulb.

If no synchronization is desired, the sync control could be left out, and the neon bulb connected to ground.

Bill W. Napier
Fort Smith, Arkansas



Ed Note:

This is the old stand-by relaxation oscillator which is ideally suited for inexpensive, moderately linear time bases. A good lamp for this circuit would be our AO 78 which has a breakdown voltage between 66-74 vdc, maintaining voltage 50-60 vdc, design current 0.3 ma, and leakage resistance of 10,000 megohms min.

*

OVER-VOLTAGE PROTECTION

Dear Sir:

I would like to suggest the following idea for using glow lamps.

During the design of special test equipment it is often necessary to protect either the tested unit or the test equipment, or both from higher than normal voltages. These high voltages can be caused by misconnection of the equipment or the tested unit.

The use of NE-2 glow lamps in series with a sensitive relay provides an inexpensive way to afford this protection.

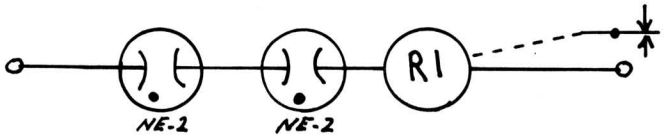
Across the terminals to be protected is placed a series of NE-2 lamps and the relay.

When the voltage exceeds the sum of the breakdown voltages of the number of NE-2 lamps in series, the lamps will ionize and cause the relay to operate. This can be used to de-energize the power source to stop the test, and the visible glow of the lamps provides an indication that over-voltage is present. This idea is usable on AC as well as DC circuits.

I have used this idea to protect voltmeters and transformers under test (to protect against incorrect connections).

Depending on the magnitude of over-voltage, this can be a severe application for both relay and neon lamps. However, if the relay is used to turn off the power source, a reasonable number of operations is expected.

Gerald S. Pail
Equip. Div. Engr.
Westinghouse Elec. Corp.



Ed Note:

This also has the added advantage that the relay is isolated from the circuit (by 500 megohms) until the over-voltage appears. This use indicates one of the basic applications of a gas discharge tube, that of a switch function. When it is off, there is no current flowing, and when it is on, a predetermined current flows.

*

SCANNING ANNUNCIATOR

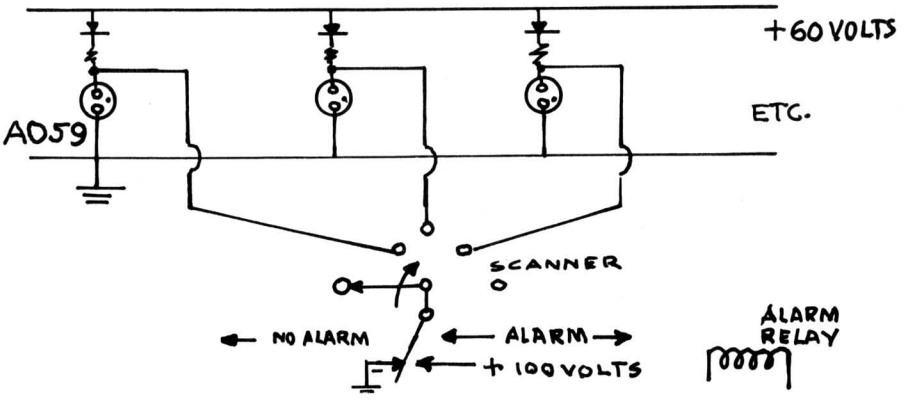
Dear Ed:

The attached circuit for a scanning annunciator might prove of interest to the readers of Signalite Application News.

As the scanner selects each alarm annunciation neon lamp, the position of the alarm-no alarm relay determines whether the lamp is to be lit or extinguished.

The diode in each lamp circuit prevents the 100 V alarm-no voltage from raising the voltage on the "60 V maintaining bus" and turning all lamps on. The dropping resistor in each lamp circuit permits shorting the lamp to extinguish it without shorting the "maintaining bus."

William F. Kamsler
Scientific Data Systems



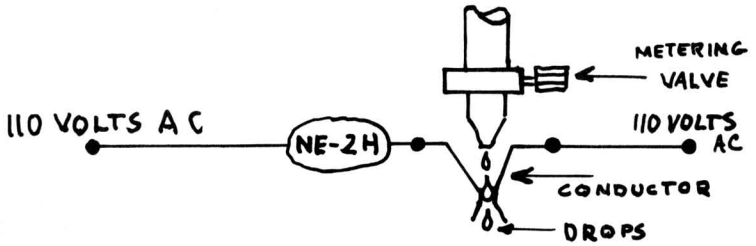
VISUAL FLOW INDICATOR

Sir:

Shown below is a glow light application which I used successfully in a diazo-type whiteprint machine as a visual flow indicator for aqueous ammonia. This system applies, of course, to any electrically conductive solution.

Drops of solution released by a metering device such as a needle valve, fall and form a conductive path between two corrosion resistant wires which are in a series circuit with a NE-2H glow light. A suitable voltage source such as 110VAC is used to flash the light.

David L. Hirsch
Hughes Aircraft



Ed Note:

We would recommend placing a 30 K resistor in the line and using our LT 2-32-1 lamp to improve results.

USE CIRCUIT COMPONENT FOR CIRCUIT APPLICATIONS

Gentlemen:

About 5 years ago we designed and built four automatic sorting control units for conveyor operation, each unit using 2,200 NE2 lamps as memory units. We purchased standard lamps and aged them for 48 hours and then tested them to meet our specifications. We could use only about 25%. The lamps have to meet the following specifications:

Supply Voltage: 63 Volts, very well regulated
Ignition Voltage: From 67 to 72 Volts
Maintaining Voltage: From 58 to 53 Volts.

Robert H. Oppenheim
Miltronics Company

Ed Note:

As we have discussed previously, indicator type glow lamps cannot be aged into reliability. However, Signalite produces many lamps designed as circuit components which exhibit reliability comparable to the most critical components in the circuit. Such lamps can eliminate the problem of discarding 75% of the shipment to find those that meet your specs. One such lamp that meets your specifications is our AO 59 which has the following characteristics: Breakdown voltage 65 to 75 vdc, maintaining voltage within ±1 volt for any value between 52 and 59 vdc, and design current 0.3 ma.

*

If you have a circuit design problem involving the use of glow lamps, or have developed a circuit in which glow lamps are important for design and or economic reasons, we would like to discuss your application in a future issue of this newsletter.

Applications which in the opinion of Signalite have significant interest will also be brought to the attention of the editors of the leading technical publications for consideration as articles and featurettes. Your by-line and company credit will be given with your permission.

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