Electromagnetic Indicator Engineering Application Notes

These generalized circuits illustrate various methods of driving our electromagnetic indicators. Presently available semiconductor amplifiers and logic switches are used. The specific application will determine the complexity of the interfacing circuitry. General guidelines to the use of our indicators are also included.

Bulletins are available for each type of fault indicator that we manufacture. Users should refer to these bulletins for operating parameters and complete specifications.

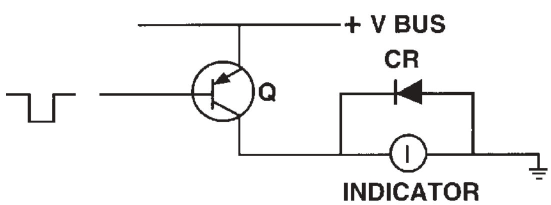
Specific application questions not covered by our bulletins should be referred to the L-3 Communications, Electrodynamics Sales Department.

Our indicators are electromagnetic devices which are typically low impedance. They are designed for specific voltages and require 50 mW to 1 watt and activating pulse widths of 20 to 100 milliseconds, depending on the device selected.

Because of the power and impedance levels a transistor switch is generally used as a driver from higher impedance sources. The transistor need not be high speed and is selected on the basis of its low "on" resistance and its current carrying ability at the highest ambient temperature encountered.

The indicator presents a highly inductive load which will cause a high voltage back-spike at the cessation of the "on" pulse. This may be removed by connecting a diode across the indicator as shown in Figure 1. Fast turn-on diodes are preferred.

The most common circuit employed by indicator users is the "open collector" transistor drive. It is used for both "set" and "reset" functions.



The circuit on the left will be found in the succeeding circuits as the switch controlling the indicators.

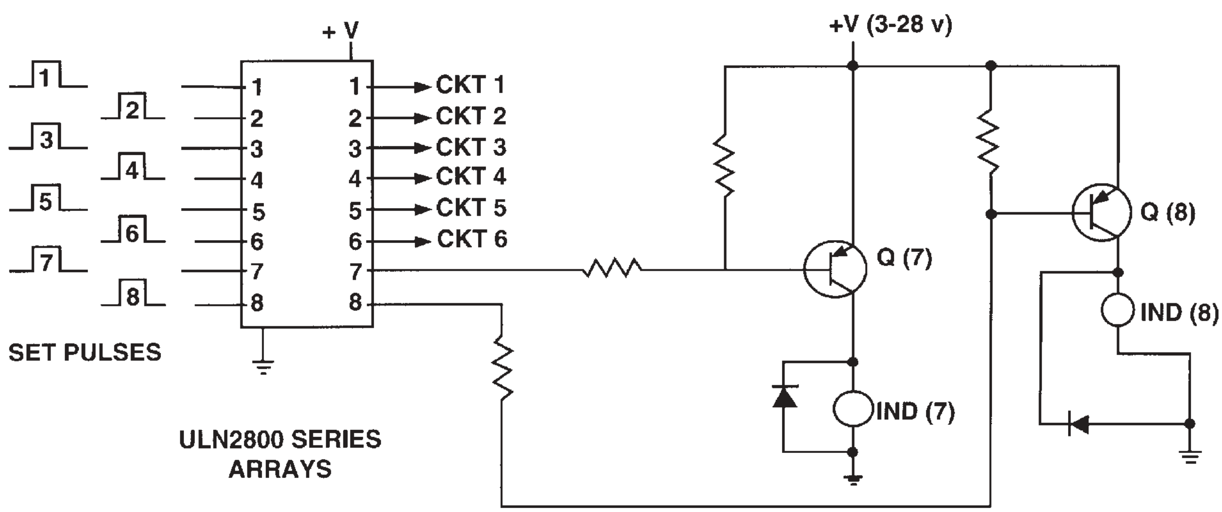


FIGURE 1

Eight channels of fault indication at higher currents may be controlled in the above manner by duplicating the output transistor circuit. If total power, voltage, and current requirements are met using sensitive indicators, the control circuit may consist of two ULN-2068 Darlington (quad) switches without using the transistor output stage.

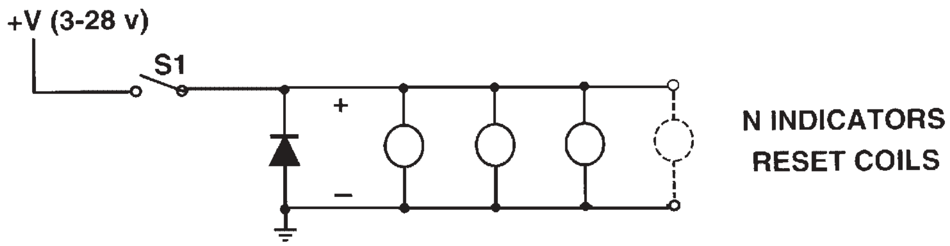


FIGURE 2

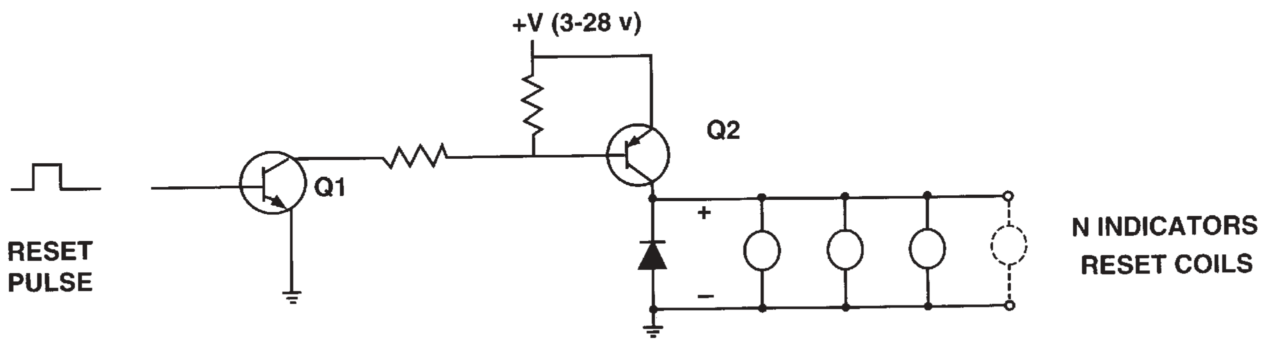


FIGURE 3

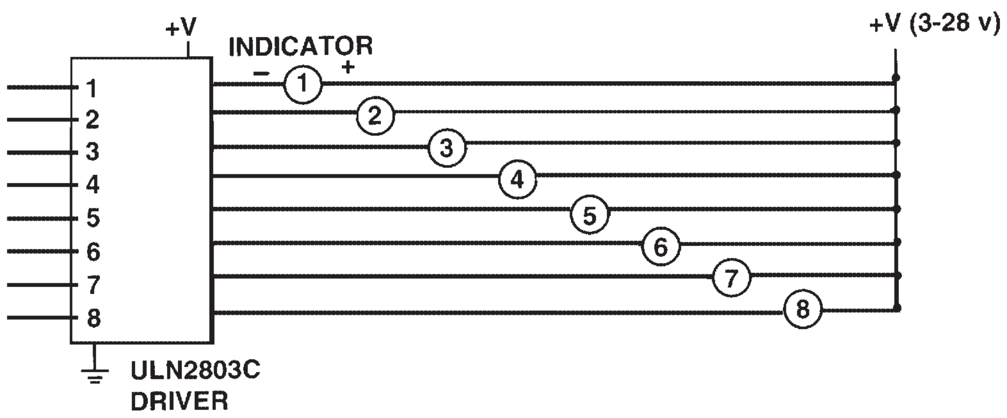


FIGURE 4

Figure 2 circuit will reset all indicators from operation of one manually operated switch.

Figure 3 circuit will reset all indicators with one positive input pulse.

Figure 4 will selectively reset eight indicators depending upon which input of the sink driver is positively pulsed. Protective diodes are built are built into the driver.

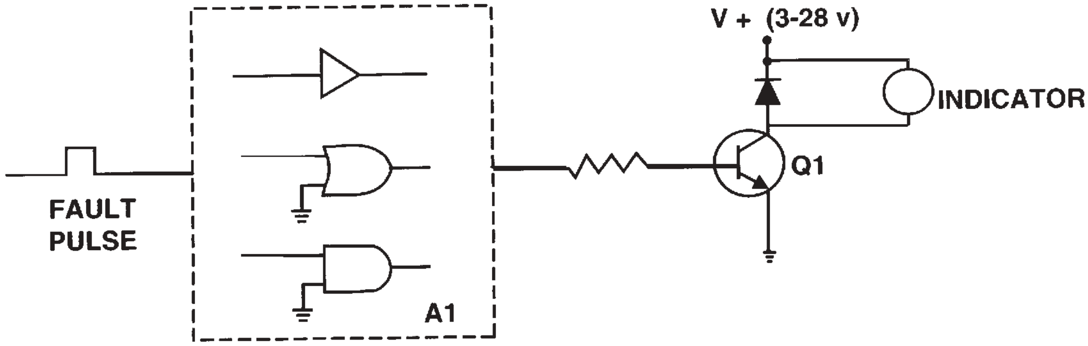


FIGURE 5

A1 of Figure 5 may consist of any logic gate as an interference with the transistor driver. The logic gate and transistor driver may be replaced by a power relay driver to UHP-400, or UHP-402.

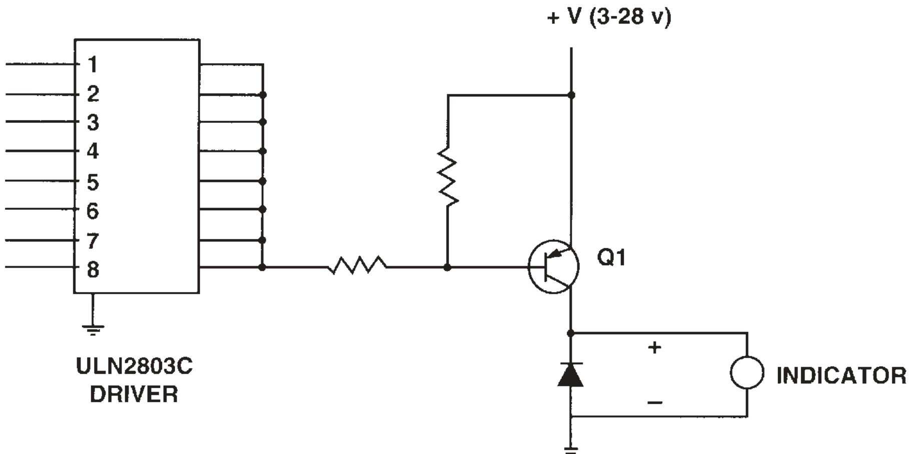


FIGURE 6
"OR" FAULT INDICATOR

A fault consisting of a positive voltage on any one (or all) of the inputs to the driver will cause the indicator to "set".

GENERAL NOTES ON INDICATOR APPLICATION

1. Series (steering) diodes and shunt diodes are often built into our indicators.

Typical diode configurations are:

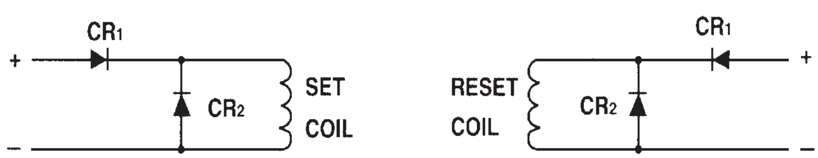


FIGURE 7

CRI insures that only the correct polarity current will flow in the set or reset coils. CR2 clamps the back-spike voltage which is present from either coil when power is suddenly removed.

2. The sensitivity of the indicator is specified as the voltage required at a minimum pulse duration to produce an indicator transfer.

In general, longer pulse applications will not reduce the peak pulse voltage required.

The pulse shape must be such that the required voltage is present over the minimum pulse length time to effect transfer.

Rise time of the applied pulse does not affect operation of the Ball or Drums indicators. Response is obtained to fast and slow pulses, D.C., and rectified A.C. as long as the pulse has the prescribed amplitude and duration. The Flag Indicators will operate upon the application of a 40-millisecond minimum, DC voltage square wave pulse with a rise time of 5-millisecond minimum. The fault indicator does not operate satisfactorily from a slowly increasing ramp voltage due to the anti-vibration feature designed into the fault incicator.

3. The minimum operate voltage may be confused with minimum non-operate requirements. The minimum voltage is designed to operate well below the minimum operate voltage in order to insure that the unit will always operate at the minimum voltage at the maximum operating temperature specified. This is necessary because the coil resistance increases with an increase in ambient temperature.

4. Since the typical status indicator is a magnetic latching non volatile device, the resistance to vibration may often be increased over specified values by reducing clearances and magnet spacing within the device.

In practically all instances, the amplitude of vibration a given type of indicator can withstand is proportional to the magnetic latching properties and therefore to the amount of voltage required for transfer. Therefore, higher vibration level resistance requires a higher voltage for transfer and an increase in the minimum operate voltage level.

Magnetic Interaction

The fundamental driving indicator elements are magnetic. To insure that the magnetic environment is free from an interfering field, the following should be considered;

1) Locate the indicators at least 0.5" apart, center to center, except where otherwise noted (some units can be mounted side by side).

2) Do not locate the device adjacent to magnetic sources such as power relays, transformers, etc.

3) Mount indicators on nonmagnetic material.

4) If it is impossible to follow the 3 rules above, then magnetic shielding may be necessary.

Operating Voltage

The nominal operating voltage is marked on the indicator case. This voltage applied @ 25°C will cause transfer at the rated ampere turns (NI). The minimum NI product must be maintained over the temperature range. An increase or decrease in temperature will create the need for a proportional change in voltage. Typically these indicators will operate 30% belong and 25% above nominal voltage at 25°C. It is recommended that nominal voltage be applied at the ambient temperature since the indicator will still be operable if the coil resistance increases due to an unforeseen increase in ambient temperature. The graph below shows the variation of minimum operate voltage with temperature.

Since these devices depend upon a constant ampere-turns for proper operation, care should be exercised when planning for temperature extremes. **See Figure 8 below.**

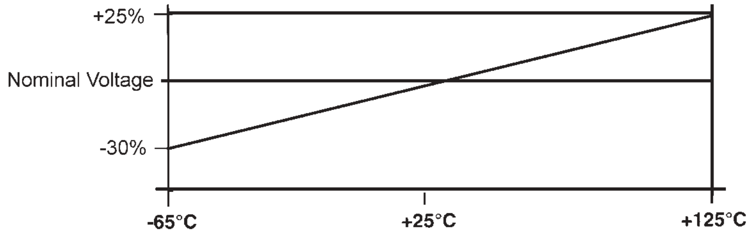


FIGURE 8

For further information please contact the Sales Department at L-3 Communications/Electrodynamics.