

Carpenter's De'Light™

An ultra-simple circuit replaces the handyman's level

By Arthur Plevy

YOU'VE probably used a carpenter's level and know that when the "bubble" is between the appropriate lines the surface is level. But how often have you strained to "read" it when lighting was poor?

The electronic level presented here eliminates this problem by using two LED indicators instead of an air bubble. (It also makes a delightful paperweight conversation piece.) If the surface is tilted to the right, one LED lights; if it's tilted to the left, the other LED lights. When the surface is level, both LEDs light.

Circuit Operation. The heart of the unit consists of two unidirectional mercury switches *S1* and *S2*. The unidirectional mercury switch has one long electrode and one short, angled electrode. The pool of mercury "rides" on the long electrode and makes contact between the two electrodes if the unit is held in a horizontal position.

Mercury switch *S1* turns *LED1* on and off, while *S2* does the same for *LED2*. The long terminals of switches *S1* and *S2* are connected together, while the short terminals of each switch are connected to their respective LEDs. The anodes of each LED are connected together and to the negative terminal of the battery. An on/off switch is connected between the battery and the long electrodes.

To operate the unit, turn switch *S3* on. If the unit is tilted to the right (left side higher than the right side) the left LED will light and the right LED will be off. If the unit is tilted to the left (right side higher than the left), the right LED will light and the left will be off. If the surface is horizontal, both LEDs will light.

LEDs do not have to be used. They may be replaced by any other indicator devices.

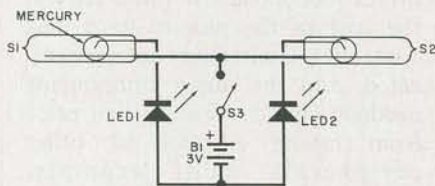
Construction. Any type of housing can be used for the level. The prototype was assembled in a plas-

tic housing. To align the unit, use a regular carpenter's level to determine that a surface is horizontal. Position the mercury switches in the housing by using a double-backed tape so that they can be easily adjusted.

Connect the electrodes of the switches as shown in the schematic. The LEDs are the high-intensity type that will illuminate using a 3-V battery (two 1.5-V cells in series). With the housing on the horizontal surface, adjust the switches so that the mercury is just in contact with both electrodes. In this position both LEDs will light.

The mercury switches can now be permanently secured in place by means of a super glue or any other adhesive desired. In the prototype, the switches were embedded in silastic to protect them. The on/off switch can be any type of inexpensive switch.

The concept of the electronic level is extremely simple. If an accurate adjustment is made in positioning the mercury switches, one can measure deviations from the horizontal of less than 1 degree. If the housing is lengthened and the mercury switches placed further apart, greater accuracy can be achieved. In the unit shown, the housing is approximately 3.5 in. long. A printed circuit board was used to allow easy construction, but this is not necessary as the wiring is not critical. ◇



The heart of the circuit is the two mercury switches controlling two LEDs.

PARTS LIST

- B1—Two 1.5-V, AAA batteries
- LED1, LED2—Red light emitting diode (Motorola 4303F1 or similar)
- S1, S2—Mercury switch (Comus CH03-0 or similar)
- S3—Spst miniature switch

Note: Mercury switches are available from New Ventures, P.O. Box 38 East Brunswick, NJ 08816 for \$3.00 each. New Jersey residents, add 5% sales tax.

