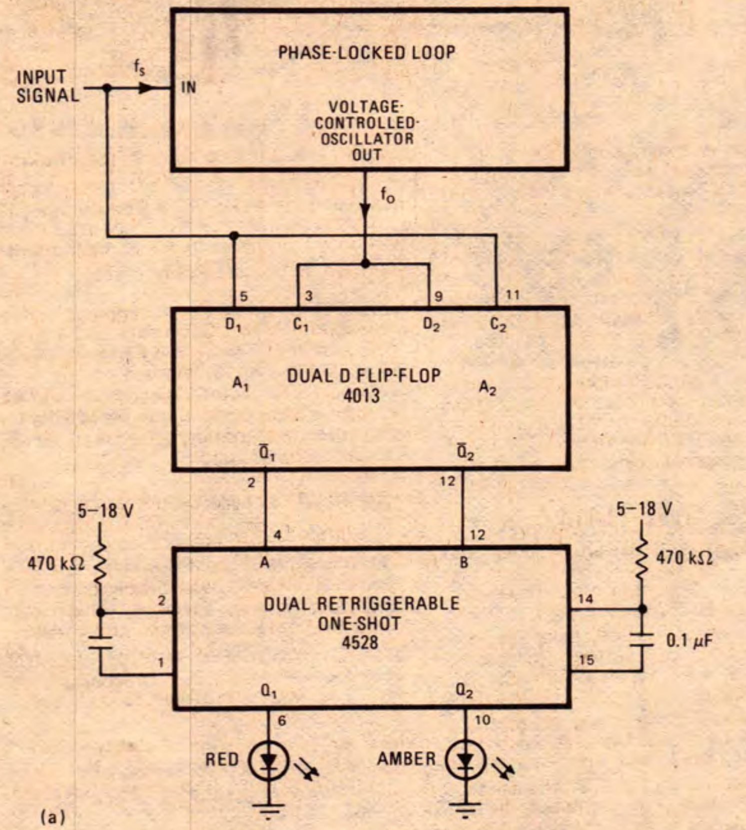
Circuit & Design Ideas

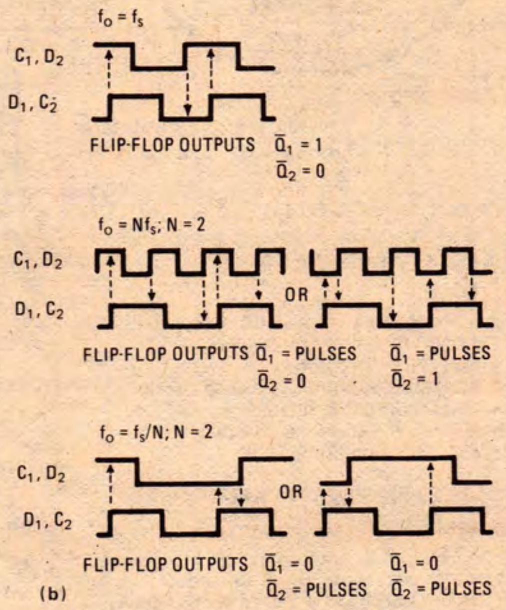
Conducted by Ian Pogson

Interesting circuit ideas and design notes selected from technical literature, reader contributions and staff jottings. As they have not necessarily been tested in our laboratory, responsibility cannot be accepted. Your contributions are welcome, and will be paid for if used.

D flipflops sense locked state of PLL



(a)



(b)

LOCKED STATE	RED LED	AMBER LED
OUT OF LOCK	ON	ON
LOCKED ON f_s	OFF	OFF
LOCKED ON Nf_s	ON	OFF
LOCKED ON f_s/N	OFF	ON

(c)

This circuit uses a dual D flip-flop to sense the locked state of many popular phase-locked loops, such as the Signetics 562 and 565. By adding a dual one-shot and LED combination to the flip-flops, the circuit visually indicates locking for the conditions where the output frequency fo is locked to the input signal fs, to its harmonics Nfs, or to its subharmonics fs/N.

The circuit shown in (a) determines whether a fixed (that is locked) relationship between fs and fo exists by employing both flip-flops in a simple phase detector. The fs signal drives the D input of flip-flop A1 and the C input of A2, and the fo signal emanating from the voltage-controlled oscillator output of the PLL drives C1 and D2. The design of the phase detector accommodates a PLL having a phase comparator that can generate an upper and lower fs-to-fo phase displacement of 180° and 0° respectively, for the locked condition. The comparator does this by deriving an fo that is displaced 90° with respect of fs when the loop is in the centre of its range.

The circuit response for a constant fo and fs may be understood with the aid of (b). Because the D flip-flops read the data signals (Di) on the positive edge of each clock (Ci), whenever the data frequency fdi equals the clock frequency fci, Q1-bar and Q2-bar of the 4013 remain fixed at either logic 1 or logic 0, depending upon whether the signals at Ci and Di are in phase or out of phase. In either case, the output from the corresponding edge-triggered one-shot in the 4528 will be zero.

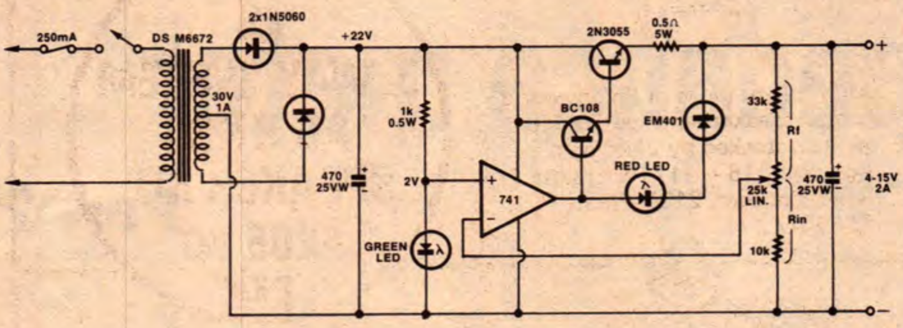
When fc is an integral multiple of fd, or fd is an integral multiple of fc, there will be a pulsed output signal from one of the output ports of the 4013 and a corresponding signal at the 4528 to light the LED. Note that because the one-shot is retriggerable, its output will be constantly at logic 1 for a pulsed input signal. The output (logic 1 or logic 0) from the other port of the flip-flop will be constant. When fo and fs are out of lock, each flip-flop reads random 1s and 0s, causing pulsed output signals to appear at both ports of the 4013. The table (c) summarises circuit operation.

In cases where it is necessary to detect only the condition fo = fs, a simpler monitor can be constructed using only a single D flip-flop and one LED that is connected to its Q-bar output. The LED will light whenever fo = fs.

(By L. W. Shacklette and H. A. Ashworth, in "Electronics".)

Novel variable power supply has many uses

This variable voltage power supply is being used by my son to power his slot car set and other small electric toys. The reference voltage (2V) is supplied by the voltage drop across the green LED



which also serves as a "power on" indicator light. With the resistance values shown the output voltage can be varied from 4V to 15V. Vo = Vref (1 + Rf/Rin).

The 0.5 ohm resistor, the EM401 diode and the red LED form a current limiting circuit which limits the maximum current to 2A, with low resistance loads or short circuits. The red LED lights when current limiting occurs, allowing it to be used as a fault indicating light. With the 2N3055 mounted on a 5cm length of Philips type 35 heat sink it can withstand a short circuit on the output indefinitely.

(By Mr M. J. Lauritsen, 7 Nicolle Avenue, Hawthorndene, Sth Aust. 5051.)

Handy patch panel in a box

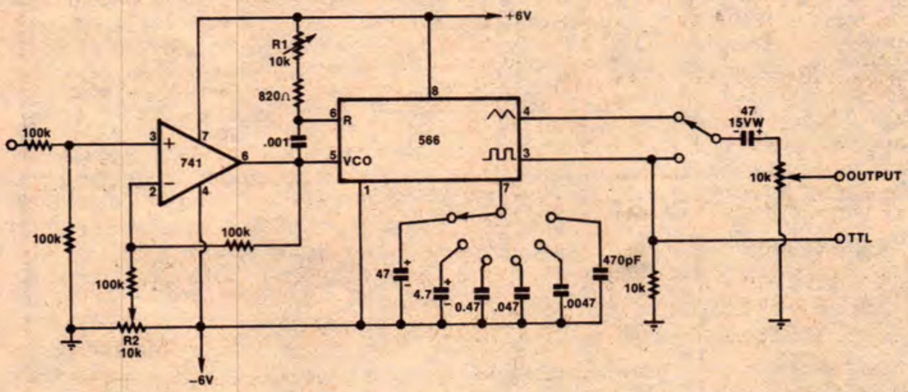
Here is a handy little unit I have evolved to solve interconnection problems. As an entertainer, I work with a variety of audio and lighting equipment of my own, which frequently has to be interconnected with in-house audio and lighting systems at various venues. Needless to say, Murphy's Law always seems to operate, so that the plugs and sockets don't mate.

To solve the problem I made up the patching box shown. It simply provides a variety of audio and other connectors, interconnected in groups. Inside the lid I carry a number of patching cords, which may be used to interconnect between the groups to provide even more permutations and combinations. Between the cords and the interconnected sockets, this provides a solution to just about every patching problem I have met.

Just which sockets you provide is up to you, of course, and you can also make the box in any convenient form. But I pass on the basic idea, as it should be of value to anyone who must set up audio and similar equipment in a variety of situations.

(By Mr. M. Ronell, 14 Griffen Street, Surry Hills NSW 2010)

FM square & triangular wave generator



A useful signal generator that can provide both square and triangular waveforms is shown in the circuit. It can be made to oscillate over a wide range of frequencies. The device will operate from 0.5Hz to 500kHz with the values of components illustrated.

The maximum output voltage of the square waveform is approximately 6Vp-p into a load greater than 2K and approximately 2.2Vp-p for a triangular waveform. R1 provides a 10 to 1 frequency variation while the selector switch S1 selects the frequency range by switching different values of capacitance into the circuit.

The 741 operational amplifier not only acts as a buffer stage to the input but also provides the correct DC level to the input of the VCO. This DC level is adjusted with the potentiometer R2. It should be set at approximately 4V to obtain minimum FM distortion.

The maximum VCO input voltage is ±0.5V and the corresponding frequency deviation is ±3.3kHz. The frequency of the modulating signal may extend from DC to about 100kHz which is adequate for most applications.

(By Mr T. G. Tang, PO Box 26, St Lucia, Qld 4067.)