Pools/Lotto Selector

now you can win on Pools as well as Lotto

Following on from the success of our "Selectalott" project we now present a Pools/Lotto number selector. It features a two-digit LED display and switch selectable Pools/Lotto operation, so you can now win on Pools as well as Lotto!

by RON DE JONG

Australians have always been "mad keen" gamblers and, it seems, "Electronics Australia" readers are no exception. So when we described an electronic Lotto selector last December, it quickly established itself as a popular project.

But the "Selectalott", as we called it, had one drawback: it didn't provide a Pools option. This immediately resulted in a stream of correspondence from readers in those states that don't play Lotto to modify the project accordingly. One Queensland reader even went so far as to send us a petition, complete with offer of a bribe!

Unfortunately, the "Selectalott" does not lend itself to easy modification to provide the Pools option because of the display format used. Instead, we have come up with a completely new design that uses a two-digit readout to display a random number between 1 and 40 for Lotto and 1 and 55 for Pools, depending on which mode is selected.

Actually, there is plenty of justification in using an electronic random number selector when playing either Pools or Lotto. The human brain is really a very poor random number generator and the mere fact that we stop to think before we select a number means that our choice is biased in some way.

We estimate that the current cost of parts for this project is about

$25

Including sales tax.

Some people would not select number 13, for example; others may be biased against consecutive numbers, low value numbers, or numbers which have already won prizes. So an inanimate, non-thinking device is a far better random number generator provided, of course, that it is properly designed

Our new Pools/Lotto selector costs about the same as the "Selectalott" (ie about $25), offers more features and is even easier to build. Incidentally, the "Selectalott" has been used religiously by four of our staff for the past six months. While they have won some minor prizes no one has yet hit the jackpot.

That, unfortunately is one "bug" we haven't found a solution for!

As you can see from photographs of the unit there are three front panel switches: an on/off switch, a Pools/Lotto selector switch, and a "GO" button. When the GO button is pressed, the two-digit display rapidly cycles through 55 to 1 for Pools and 40 to 1 for Lotto. This happens far too quickly for the eye to see so that when the button is released a random number – i.e. the last number on the display – will appear.

How It Works

Looking at the circuit now, we have used five CMOS ICs plus two seven-segment displays. Operation of the circuit is quite straightforward. Basically, IC1 comprises an oscillator which clocks a two-digit BCD counter consisting of IC2 and IC3. Outputs from these counters are decoded by IC4 and IC5 to drive the two seven-segment displays.

The oscillator circuit is a standard three-gate CMOS oscillator comprising IC1a,b,c. Normally, the time constant (ie, the oscillator frequency) would be determined only the .001μF capacitor and 220kΩ resistor. In this case, however, we have also added a 2.2kΩ resistor and series diode in parallel with the 220kΩ resistor.

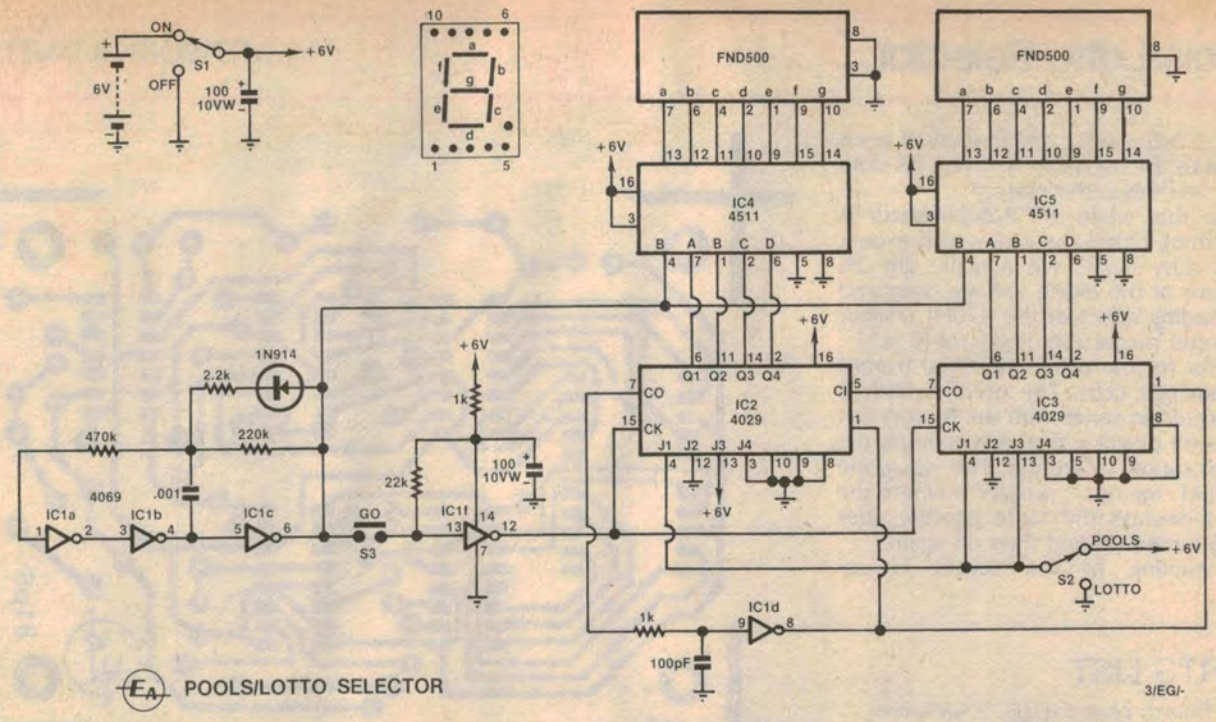
This reduces the duty cycle – ie the period for which the output is high divided by the total period – to around 2%. While this has no effect on the counters it is important for the displays as we shall see later.

Output from the oscillator is taken from pin 6 of IC1c and this passes to IC1f when the GO button is pressed, to drive the two BCD counters, IC2 and IC3. When the button is not pressed, the input to IC1f is pulled high via a 22kΩ resistor and counting is inhibited.

IC2 and IC3 are 4029 CMOS up/down binary/decade (BCD) counters – to give them their full title. As the name implies, these can be used to count either up or down in binary or BCD mode by setting the appropriate control pins. In this case, the 4029s have been programmed to count down in BCD (or decade) fashion, ie 9, 8, 7 . . . 0 then back to 9 again.

Since we require IC3 to count in units and IC2 to count tens, we have configured the counters in a parallel clocking mode with the carry out pin of IC3, pin 7, connected to the carry in pin of IC2, pin 5. This works as follows: the carry out pin will go low only when the IC3 is at count 0 and the carry in pin of IC2 must be low to enable counting. So the tens counter, IC2, will only be clocked when IC3 is zero; eg when the count is "50", the next clock pulse will decrement both IC2 and IC3 to give "49".

So far we have the counters counting continuously from 99 down to 0. Now to



EA POOLS/LOTTO SELECTOR

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make them count from 40 to 1 or 55 to 1 we use the preset enable (pin 1) on each counter to load the BCD data at the parallel inputs, J1 to J4, into the counter.

Both preset enables are connected to IC1d which inverts the carry out from IC2. This carry out is low only when both counters are 0; thus as soon as the 0 count is reached, IC1d goes high to load the parallel inputs into the counter.

For Pools the parallel inputs are set to 55 – ie a 5 is loaded into each counter – while for Lotto a 4 is loaded into IC2 and a 0 into IC3 to give 40. Those data bits which are common to 55 and 40 are hard wired, eg, J2 and J4 on IC2 go to ground and J3 to +6V, while the bits which have to be changed are switched to 0 or +6V via switch S2, depending on whether Pools or Lotto is selected.

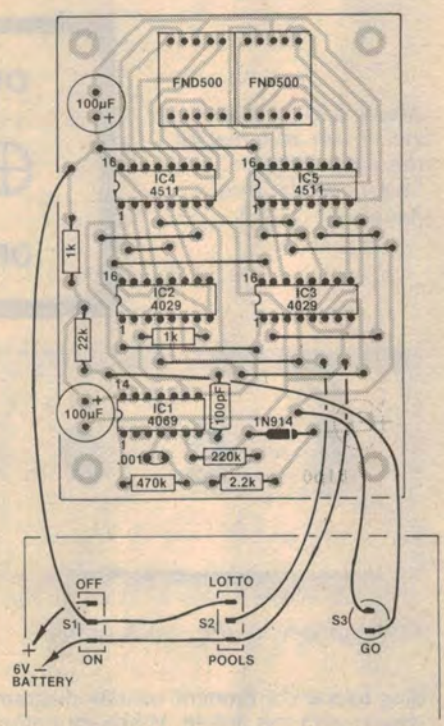
One point not mentioned so far is that a 1kΩ resistor and 100pF capacitor deglitching network is included in series with the carry out pin of IC2 (pin 7). This removes a timing glitch caused by the delay in the carry out from IC3, which would otherwise result in premature resetting of the counters at the count of 10.

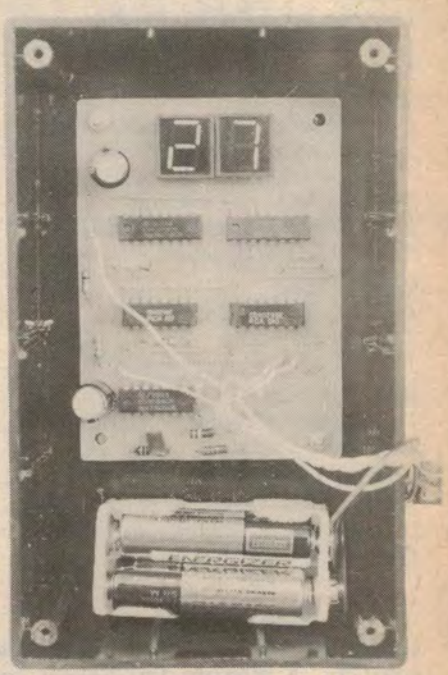
To explain further, at the count of 10 the carry out of IC3 (pin 7) goes low and clocks IC2 to 0. As there is now some delay before pin 7 of IC3 goes high again, IC2 will generate a brief carry out pulse. This pulse would cause premature resetting of the counters unless filtered by the deglitching network.

The BCD outputs from IC2 and IC3 are applied to IC4 and IC5, both 4511 CMOS seven segment LED decoder drivers. These directly drive two FND500 common-cathode displays without segment resistors. Normally, this would result in a very large segment current and a very bright display – at least until either the 4511s or FND500s failed. We avoid this problem by using the blanking input on the 4511s, pin 4, to turn off the display for 350μs and on for only 7μs; ie a 2% duty cycle.

This has the same effect as multiplexing the displays and considerably reduces power consumption for the same apparent display brightness. In fact you may find it hard to believe that the total current consumption is just 20mA– it literally runs on the smell of an oily rag (well almost). Other benefits include very low power dissipation in the 4511s and FND500s.

The blanking input signal to which we referred is the clock signal from pin 6 of IC1c. We mentioned earlier that an addi-





Construction is easy – just follow the wiring diagram (left) and the photograph at right. The board is mounted using brass standoffs.

tional 2.2kΩ resistor and diode had been added to the oscillator to give a 2% duty cycle and this is the reason.

Note that while the 2.2kΩ resistor is 1/100th of 220kΩ and one would expect a 1% duty cycle, we actually get 2% because of the diode voltage drop and the loading effect of the 470kΩ resistor and input protection diodes of IC1a.

Power for the unit is obtained from 4 AA penlight cells. The on/off switch is connected in series with the battery but in the off position the switch shorts the power supply to ground. This was done to avoid "memory" problems where the circuit displays the same number after being turned off and then on again.

Decoupling of the supply is accomplished by a 100μF electrolytic capacitor. A separate 1kΩ resistor and 100μF capacitor decouple the supply to the oscillator IC1 to avoid biasing due to variations in supply voltage. This occurs because of the variation in current drawn by the displays during the counting sequence.

PARTS LIST

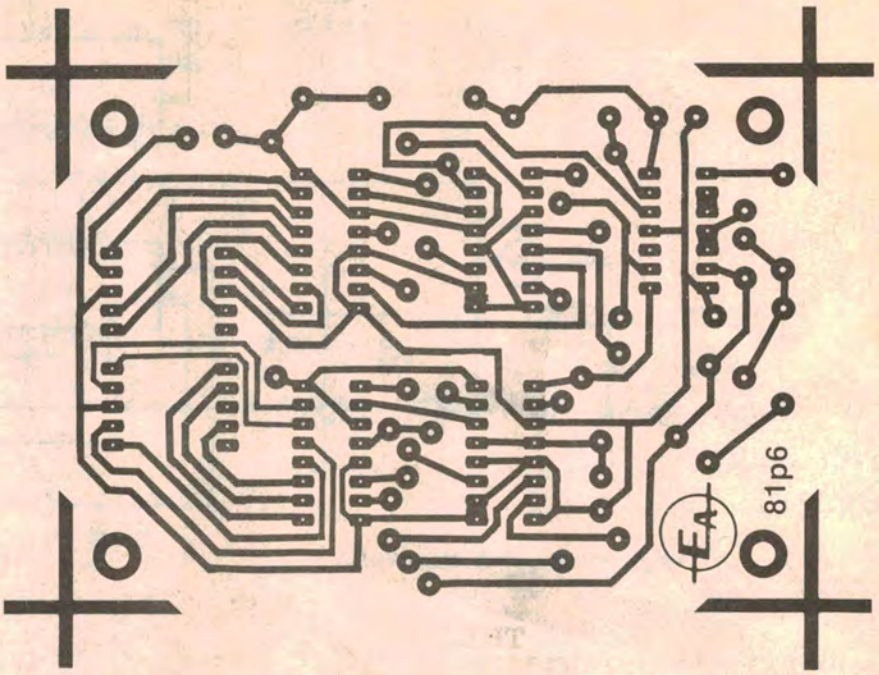
1 PC board, coded 81p6, 97x69mm.
1 zippy box, 96x159x51mm
1 piece of perspex, 89x153mm
2 SPDT miniature toggle switches
1 momentary contact pushbutton switch
1 square 4xAA battery holder
4 AA Penlight cells
1 battery clip to suit holder

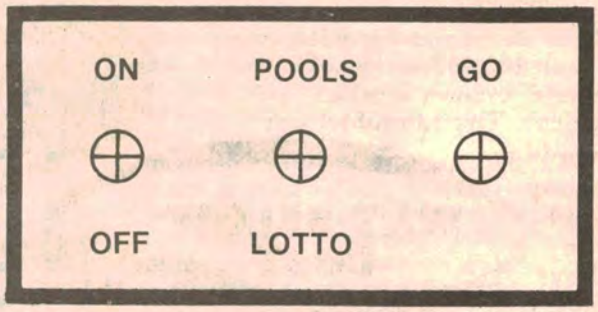
SEMICONDUCTORS
2 4511 CMOS latch decoder drivers
2 4029 CMOS up/down binary/decade counters
1 4069 CMOS hex inverter
2 FND500 7-segment LED displays
1 1N4148, 1N914 diode

CAPACITORS
2 100uF 10VW PC electrolytic
1 .001uF greencap
1 100pF ceramic or polystyrene

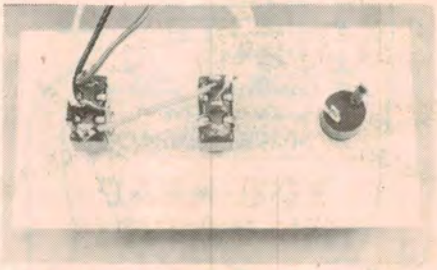
RESISTORS (all ¼W, 5%)
1 x 470kΩ, 1 x 220kΩ, 1 x 22kΩ, 1 x 2.2kΩ, 2 x 1kΩ

MISCELLANEOUS
Screws, nuts, hookup wire, tinned copper wire, solder, four brass standoffs.





Above and right are actual size artworks for the printed circuit board and the front panel.



Close-up view of the switch wiring.

CONSTRUCTION

Well that covers the circuit description. Construction is quite simple with most components being mounted on a single printed circuit board (PCB) coded 81p6 and measuring 97x69mm. Mount the links, resistors and capacitors first according to the component overlay diagram shown with this article. When mounting the CMOS ICs take the usual precautions against damage due to static electricity.

The FND500 displays are also mounted on the board. The correct orientation of the displays is with the decimal point (just visible behind the red plastic filter) in the lower right hand corner. The top of the displays can also be identified by corrugations.

We housed our unit inside a plastic zippy box measuring 96x159x51mm. To simplify construction and add some novelty to the project we replaced the aluminium lid with a clear perspex lid. The board is mounted on the bottom of the box using brass standoffs. Holes for the three switches can be drilled in the perspex using the photographs of our unit as a guide, then the switches mounted and wiring completed using the wiring/overlay diagram as a guide.

Actual size artwork included with this article can be photocopied and glued to the inside of the box to provide labelling for the switches.

With that completed the wiring and orientation of components etc should be checked. If you are satisfied that all is well switch on and check out the operation of the circuit. Note that one or both of the displays may be blank when the unit is first turned on because an illegal BCD digit from the counters (ie a value, greater than 10) causes the 4511s to blank the display. This is not a problem in normal operation because the counters will always count in BCD.

When the "GO" button is pressed the display will show what appears to be 88, but, this is actually the counters counting rapidly through the numbers 55 to 1 or 40 to 1.

If the unit checks out you will be one step closer to the jackpot.