CALCULATING PARALLEL RESISTANCE PAIRS

Using a programmable calculator to find two resistance values to substitute for an unobtainable one

By Kevin Quinn

EVEN in this age of the IC, experimenters are often faced with the simple problem of paralleling two resistors because a component with the exact value isn't available. For example, you may need a 15-ohm resistor, but there's none in your box. Formulas are of little help, since you're looking for *two* unknowns. So what do you do? Here are a few ways to solve the problem.

If you need a 15-ohm resistor, multiply 15 ohms by a number such as 4. You get 60 ohms—that's one resistor, *R1*. Then divide 60 by 3—that's 20 ohms for *R2*. Resistors *R1* (60 ohms) and *R2* (20 ohms) in parallel give you 15 ohms.

Another way is to multiply 15 ohms by 3, so that *R1* equals 45 ohms. Then 45 divided by 2 gives 22.5 ohms for *R2*. Another pair! You can do the calculations in your head. It's much easier than "the reciprocal of the sum of the reciprocals."

One other way to solve the problem is with a programmable calculator. You can set up a simple program that will give you 5 or 6 pairs in no time. The program for a TI machine is shown below.

Begin by entering the number of the desired resistance. Press R/S. Then enter the multiplier. The number that will be displayed is *R1*. Press R/S. The next number displayed will be *R2*. Press R/S again to repeat the cycle.

Sometimes this method gives values that do not correspond to standard values such as 47 kilohms or 82 kilohms. But in the trials we made, using the closest standard values (47 kilohms for 49 kilohms, etc.) worked out to an accuracy of better than 5%.

To find 3 or more resistors equivalent to the desired value, first find the first two values. Then use one of them as the new desired value and find two more. For example, if the desired value is 47 kilohms,

$47 \times 5 = 235$	(R1)
$235/4 = 58$	
$58 \times 3 = 174$	(R2)
$174/2 = 87$	(R3)

Using standard values of 240 kilohms, 180 kilohms, and 91 kilohms in parallel will give an equivalent resistance of 48 kilohms. Usually, this is close enough. ◊

00	x	09	=
01	R/S	10	÷
02	STO 1	11	RCL 2
03	=	12	=
04	STO 2	13	1/x
05	R/S	14	R/S
06	RCL 1	15	RST
07	−	16	R/S
08	1		