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Table 1.

	A	B	C	D	E	F	G
P. Höfs	0	1	1	1	1	1	0
	1	0	1	1	0	0	0
	2	1	1	0	1	1	0
	3	1	1	1	1	0	0
	4	0	1	1	0	0	1
	5	1	0	1	1	0	1
	6	1	0	1	1	1	1
	7	1	1	1	0	0	0
	8	1	1	1	1	1	1
	9	1	1	1	0	1	1

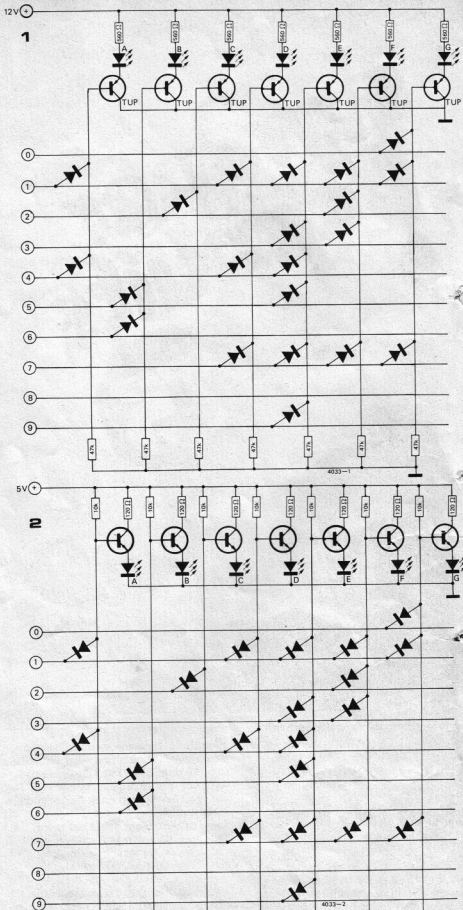
Cold-cathode numicator tubes are gradually passing out of use and are being replaced by various types of seven-segment displays. As the life of these tubes is about 10 years there are still many serviceable pieces of digital equipment around which, although in good working order, have tubes that are beginning to fail. Some readers may have DVM's or digital clocks, which they would like to convert to a seven-segment display.

This article describes two simple decoders, which will convert the decimal output of the numicator decoder to a seven-segment code. The circuits are also useful for demonstrating seven-segment displays using a ten position single-pole switch to programme the numbers.

To work out the simplest decoding circuit it is first necessary to draw up a truth table for the seven-segment display (table 1). A '1' in a column indicates that the particular segment is illuminated. A '0' indicates that it is extinguished.

It is apparent that there are a great deal more 'ones' in the truth table than there are 'noughts', 49 as against 21. It is therefore evident that the simplest conversion will be achieved via the 'noughts', i.e. all segments are normally illuminated and the ones not required for a particular digit are suppressed. The decoder consists basically of a diode matrix. The rows of the matrix are the decimal inputs, whilst the columns are the outputs to the seven segment display. Where a digit requires that particular segments be suppressed, diodes are connected from the appropriate row to the appropriate columns. Two versions of the decoder are shown in figures 1 and 2. Figure one is intended for positive logic inputs, i.e. when a particular digit is enabled, that row input is 'high' and all the others are low. The TUP's are all normally turned on, but when a particular digit input goes 'high' then the diodes connected to that row hold the bases of the transistors connected to them to about +11.4 V, thus turning off the transistors and extinguishing the appropriate display segments.

The version of the decoder shown in figure 2 is intended for negative logic inputs such as numicator tube decoder outputs. The transistors are all normally turned on, but when any row input goes 'low' it will ground the bases of the transistors connected to it by diodes,



decimal to seven segment converter using 21 diodes

thus turning them off. The two versions of the decoder are shown for different supply voltages, but

either may be used with the other supply voltage by substituting the resistor values from the other circuit.