CALENDAR

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A circuit for producing a calendar display using the pulses from a digital clock has already been described in Elektor 8. This design provides an alternative circuit which gives day, date and month display, plus flashing display facility to draw attention to dates of particular interest.

The calendar is advanced by the 24 hr (i.e. midnight) pulses from a digital clock. Each pulse steps the date and the day displays by one. To facilitate the initial setting of the display, a higher frequency signal must be provided. The most suitable and convenient is the seconds pulse train from the clock. Logic is included in the circuit to enable the month display to change on the appropriate date. The only manual intervention necessary is the setting of a switch to indicate 'leap year' when necessary.

The date indication is by a pair of 7-segment units, while the day and month are displayed on illuminated windows in a suitably divided rectangular mask. A suggested lay-out for the front panel is shown in figure 5.

Day of the week display

Figure 1 gives the circuit diagram for the day display. The input is normally from the once-per-day 24 hr clock pulse, but it may be switched to the once-per-second pulse, by S1, when required. In either case the input signal is fed, via a decoupling capacitor, to the input of the counter IC2 (7493) where the negative-going edge triggers the count.

The output of IC2, three bit BCD, is routed to the inputs of IC1 (7445). The count is automatically reset to zero when the value seven (BCD '1,1,1') is reached.

The values 0-6 of the count correspond to the days Monday - Sunday respectively. The BCD-decimal decoder chip IC1 takes the binary input and produces 10 outputs which can drive 80 mA loads.

Setting the day display to the correct value is achieved by feeding seconds pulses to IC2 (via S1).

The seconds pulses are also used in this circuit to provide a flashing display to draw attention to dates of interest. These one second pulses are gated by the flash enable input (connection 6). When they are passed by N1 to the fourth (D) input pin of IC1, the output is periodically inhibited. The selected lamp will then flash once a second.

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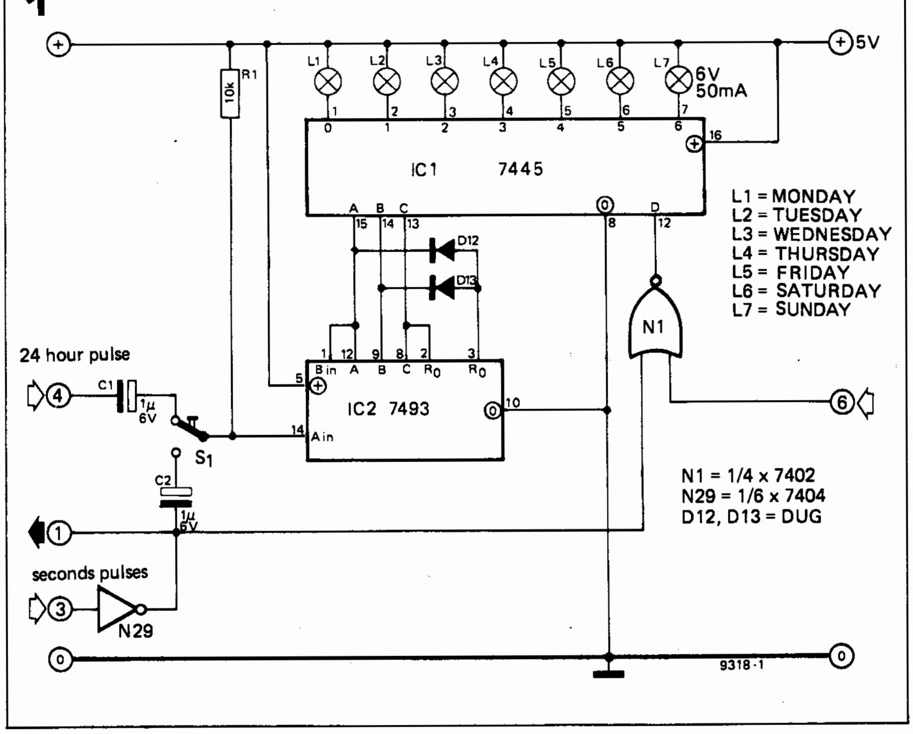


Date display

The date display circuit is shown in figure 2. It consists of two counters constructed from flip-flops. A decimal counter is formed by FF1, FF2 (7476) and FF3, FF4 (7473), while FF5, FF6 (7473) form a divide-by-four counter. The operation of the decimal counter is best explained by considering the events which occur when the tenth input pulse arrives. This pulse must reset the counter to zero. The tenth pulse causes the Q outputs of both FF2 and FF4 to be high, so the output of NAND gate N33 goes to 0. This signal resets FF1 (i.e. the Q output goes to 0) and is inverted before being used (via N2) to reset FF2, FF3 and FF4. The falling edge of the Q output of FF4 increases the count of the divide-by-four circuit. The units of the date display (M1) are supplied by IC3, a BCD-to-7 segment decoder (7447), which uses the output of the decimal counter as its input. The tens of the date (M2) are supplied by IC4 (another BCD-to-7 segment decoder) using the output of the divide-by-four counter.

The monthly resetting of both counters is achieved by gates N18-N22. After this reset, the date must be 'one' not 'zero', therefore the decimal counter states A,B,C,D must be at 1,0,0,0 for the units, and the divide-by-four counter must be 0,0 for the tens. The operation is as follows:

in the normal state, the outputs of N19-N22 are all high, so that the output of N18 is low. The outputs of N25 and N26 are therefore high and have no effect on FF1, FF5 and FF6.

Similarly, the reset signal to FF2, FF3 and FF4 is high (provided no clear signal comes from N33 as already described). If one of the inputs 28, 29, 30 or 31 goes to logic 1, then the output of the corresponding NAND gate goes to 0, provided that the other inputs

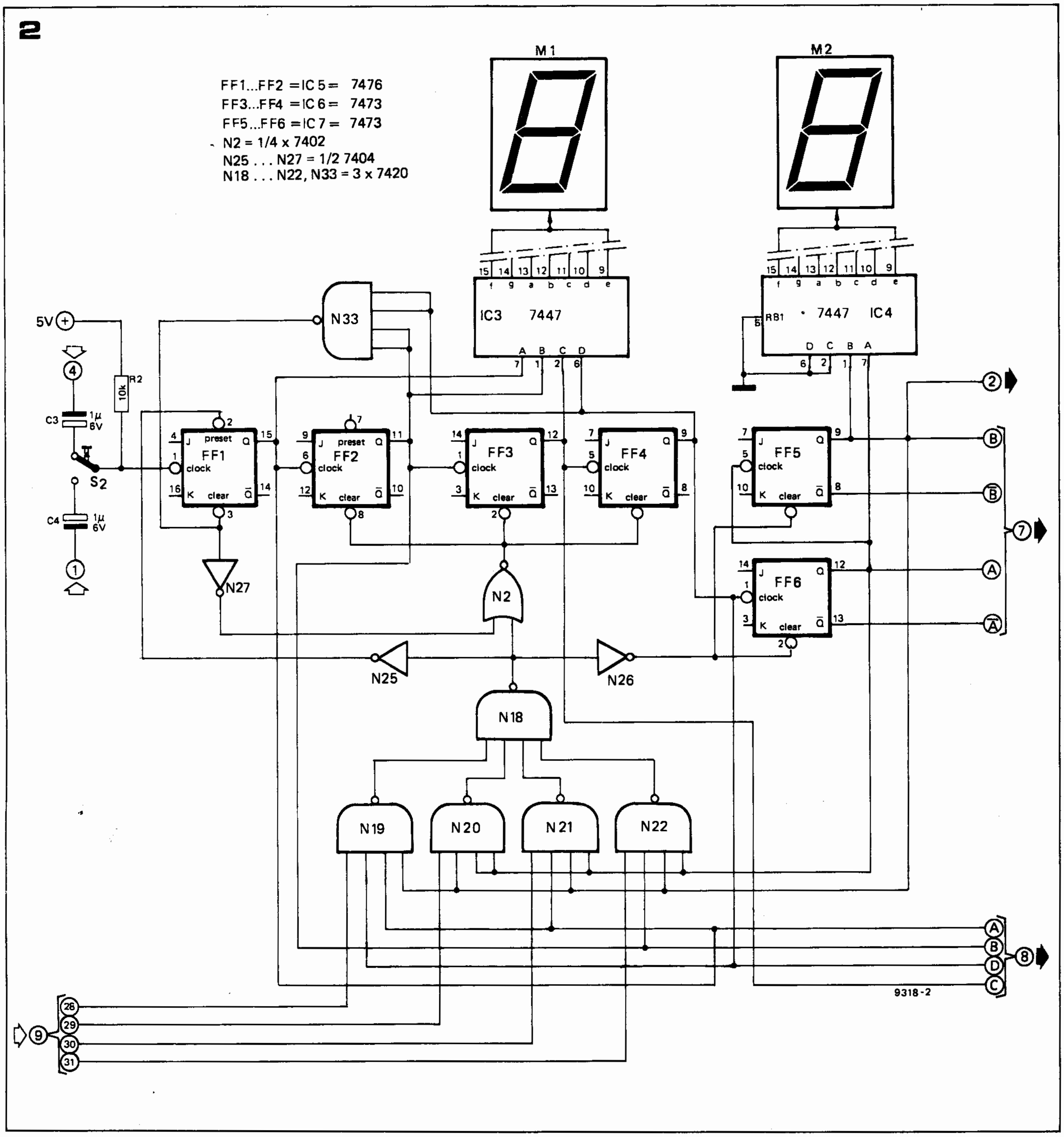


Figure 1. Circuit diagram for the day display. Each of the seven lamps corresponds to a day of the week.

Figure 2. Circuit diagram for the date display, which consists of two 7-segment numbers.

(taken from the two counters) are also 1. Connection 9 (inputs 28 to 31) is taken from the month display circuit and indicates the number of days in the month at present being displayed.

As an example: the date count is at 28 and the input pin 28 is high. The next incoming pulse sets the counters to 29 (i.e. the divide-by-four counter has the value 2, and the decimal counter has 9). All the inputs to gate N19 are therefore at logic 1, so the output is 0. The output of N18 goes to 1 causing FF2-FF6 to be reset, and FF1 to be set, so giving the desired output of 1 for the first of the month. The leading zero is suppressed by earthing the R_B input of IC4. This improves the legibility of single digit numbers.

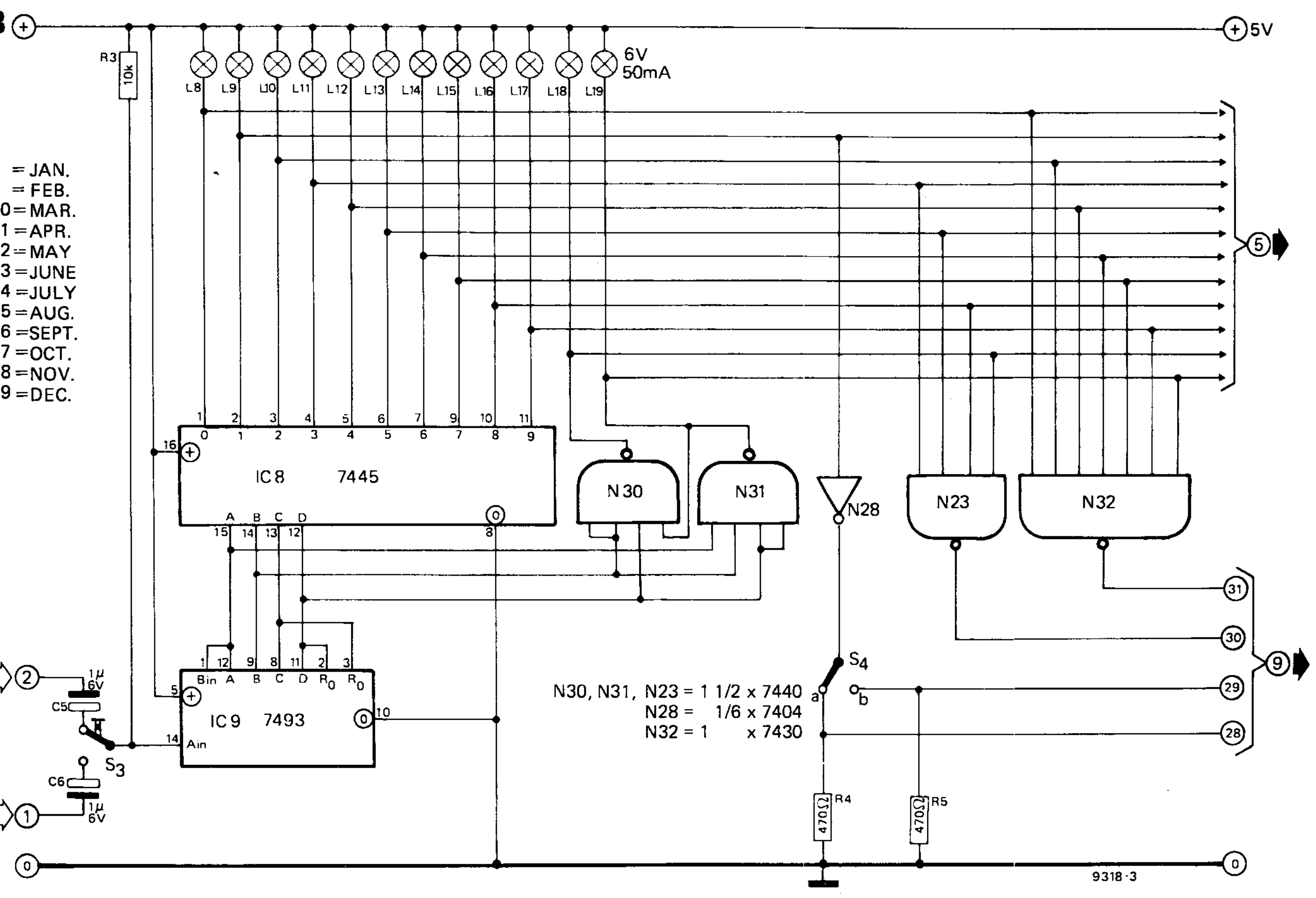
Initial setting of the date is achieved by feeding second pulses to the circuit by means of switch S2.

Month display

The month display (figure 4) is the same in principle as the day display, except that there are twelve lights instead of seven. As the decoder IC8 (7445) only has ten outputs available, two NAND gates (N30 and N31) are used for the other two. The output state of these gates is low for the values 10 and 11 from the counter, corresponding to the months November and December, respectively. These gates drive the lamps L18 and L19.

Resetting to zero, i.e. January, occurs at the thirteenth input pulse, which causes the counter to go to the value twelve, momentarily. This resets the

3



counter to zero because of the connections from D to R_{01} and C to R_{02}. The input to IC9 is normally supplied from FF5 (see figure 2) via connection 2. However, switch S3 is used for setting. Automatic resetting of the displays requires a further item of information, i.e. whether the month has 28, 29, 30 or 31 days. This information is coded by the inverter N28 and the NAND gates N23 and N32. If, for example, L9 is lit, which means the month is February, then either lead 28 (for a 'normal year') or lead 29 (for a 'leap year') is at logic 1, depending on the position of switch S4. Inputs to the NAND gates are, however, all high, so the leads 30 and 31 are both low. Each light, when lit, produces the correct output at connection 9. Only the item 'leap year' needs to be fed in manually.

Date reminder

Figure 4 shows the circuit of the date reminder, which enables the day display for certain selected dates to flash, as explained earlier. This facility is an optional extra to the calendar, included for those who have difficulty remembering such things as your nearest and dearest's birthday.

The memory consists of a diode matrix, the NOR gates N3A . . . N13, the decoder IC10 (7442) and the NAND gates N14 . . . N17. IC10 decodes the units of the date and the gates N14 . . . N17 decode the tens. Eleven of the twelve month inputs are always high, with only the month at present being displayed providing a low input. Every date gives a unique output.

For example, consider the coding for February 16th:

IC10 : the sixth output is low (pin 7) and so the input to gates N4C, N8A and N11B are also low.

N14 . . . N17 : the output of N16 is zero, and also therefore, the second input to N8A.

Input 5 : 'February' is at zero, so the third input to N8A is taken to zero via diode D1.

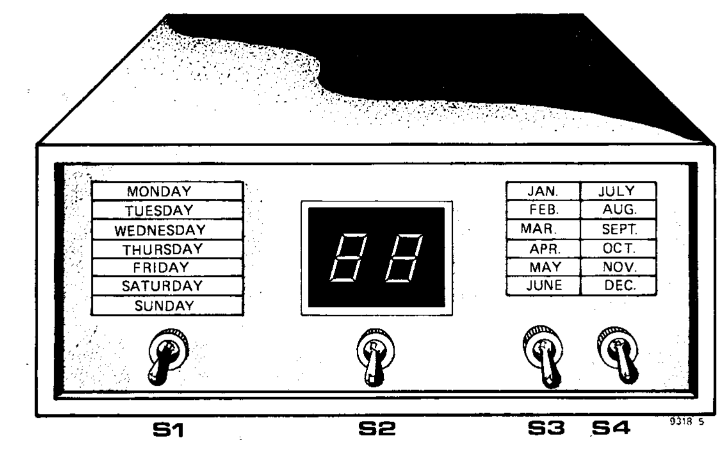
The output of N8A is therefore at logic 1 which provides the flash enable signal at output 6, and the day display will now flash (see text: day display). As an example, the memory is shown with several diodes (D1 . . . D11) connected, each one of which corresponds to one date in the year.

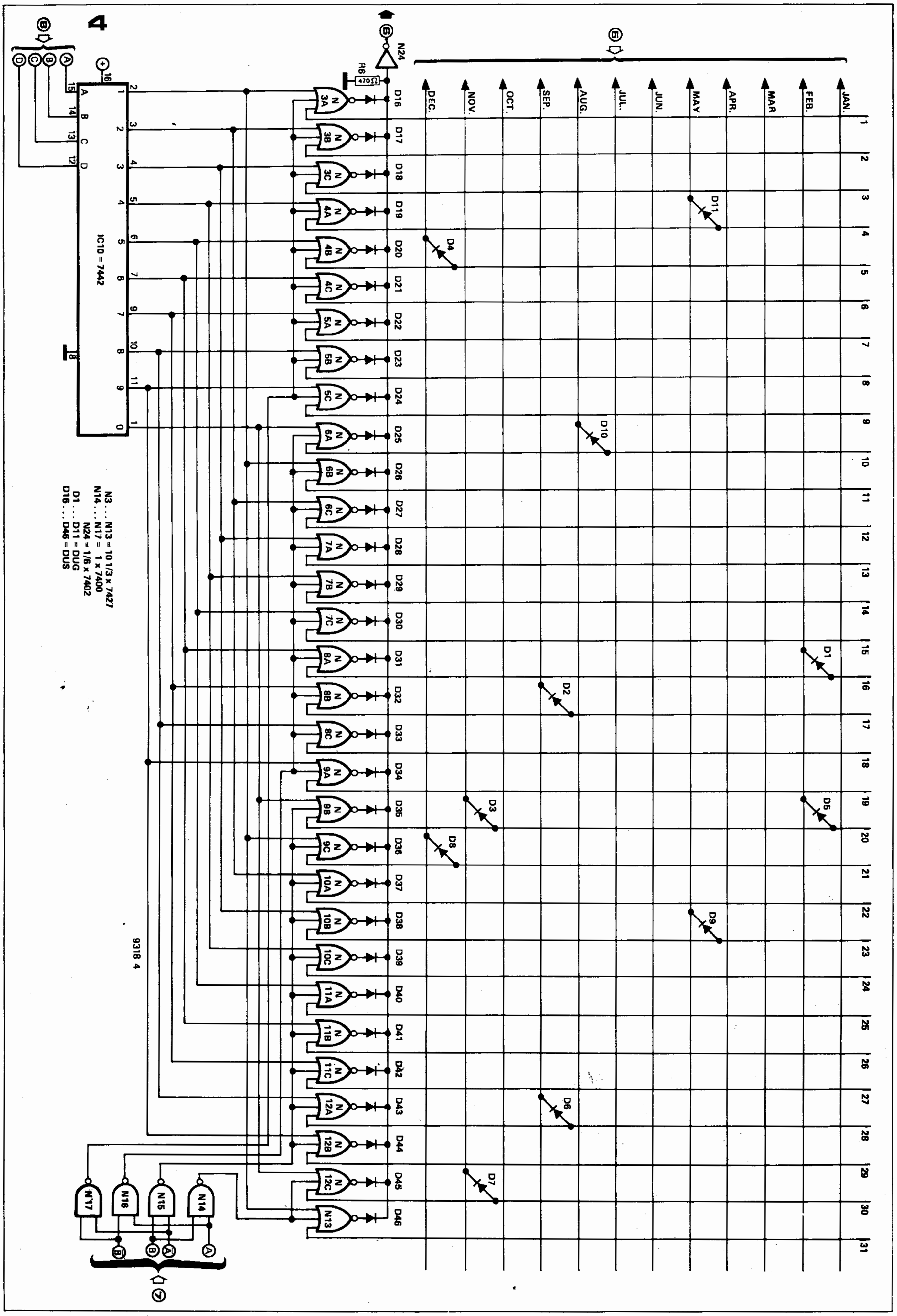
Figure 3. Circuit diagram for the month display, which is the same in principle as the day display circuit, but of course, twelve outputs are required.

Figure 4. The programmable memory for important dates. As an example, several dates have been programmed by means of the diodes shown.

Figure 5. A suitable front panel for the calendar. A red sheet of Perspex over the whole front gives good legibility and a pleasing appearance.

5

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IC10 = 7442
N24
R6
470Ω
JAN.
FEB.
MAR
APR.
MAY
JUN.
JUL.
AUG.
SEP.
OCT.
NOV.
DEC.
N3 . . . N13 = 10 1/3 x 7427
N14 . . . N17 = 1 x 7400
N24 = 1/6 x 7402
D1 . . . D11 = DUG
D16 . . . D46 = DUS
9318 4