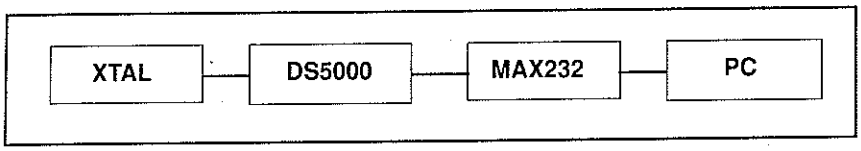


Fig. 1. Block diagram of a simple DS5000 system.

battery-backed RAM configured as internal memory replacing the internal EPROM and ROM provided by the 87C31 and 83C31 respectively. The Dallas family of devices have the part number DS5000.

The simplest circuit required to build a working DS5000 development system consists of a crystal, an RS232 voltage converter, a few capacitors, some resistors and a PCB—see Fig. 1.

The critical feature of the DS5000 is a bootstrap loader to initialize, load and configure the internal RAM. In parallel with the on-chip battery-backed RAM is a small ROM-based monitor program. The decision to boot from RAM or EPROM is determined by the PSEN line during reset. If PSEN is held low and the reset line is high when power is applied to the processor, the monitor program is selected.

The monitor offers a few simple functions. These include the capacity to download or upload Intel hex files through the serial port and configure the internal RAM as data or program memory. For those people that are sensitive about copyright protection, there is encryption hardware provided for programs stored in internal program memory. The encryption key is also defined using the bootstrap monitor. As it is unnecessary to program and erase EPROMS, the entire turn-around time for code development has been reduced significantly to a few minutes.

Unfortunately, the code development cycle is still a code, power-up and run scenario. No additional debugging information has been provided.

By executing a small monitor program residing in the DS5000 communicating with the PC through the serial port, the PC can interrogate the status of the microcontroller's internal and external RAM, special function registers, and so on. The data is presented to the user on PC; consequently, the size of the code in the microcontroller is kept to a minimum. However, sophisticated debugghing information (disassembly, memory dumping, single stepping, break points, etc.) can be generated as a sequence of transparent data transfers using the simple DS5000 monitor commands. If the DS5000 is configured in single-chip mode, and the port pins are attached to a ribbon cable terminated in a 40-pin DIL socket and an RS232 drive is connected to the serial port, an extremely low-cost ICE can be built.

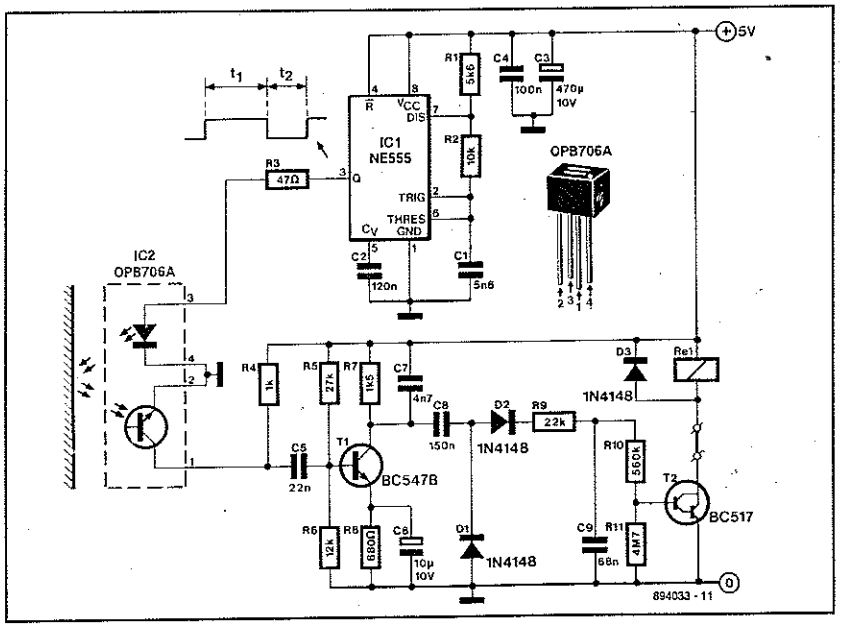
The hardware for the ICE (described in a forthcoming article) is less than £100. PC-based communications and debugging software is available for £75. Future articles will highlight features of the 8031 architecture during the description of applications. These applications and articles will probably include a dark-room timer with phonetic speech timing and a greenhouse watering system. ■

DAYLIGHT-RESISTANT OPTO-ISOLATOR

Many *X–Y* plotters, particularly the DIY type, have, for all sorts of reason, no protection against incident light, so that the photo-transistor in the opto-isolator can not differentiate between the light from the associated LED and daylight. The circuit shown here offers a solution to this problem.

A Type 555 timer pulses the LED in the opto-isolator at a rate of 10 kHz. If, at the receiver end, only the signal at that frequency is amplified, neither daylight nor bright artifical light can disturb the operation of the light barrier.

At a pulse rate of 10 kHz, the pulse spacing is 100 µs. If the duty factor is 6:4, the pulse width is 60 µs. At that rate, the LED can be pulsed at about 45 mA. The pulsating current is fully compensated in relation to the voltage by C3.



The on-time of the pulse signal at the Q output of IC1 is determined by R1-R2-C1 and the off-time by R2-C1:

pulse width $t_1 \approx 0.693C1(R1+R2) \approx 60$ µs;

pulse spacing $t_2 \approx 0.693C1R2 \approx 40$ µs.

The receiver in the opto-isolator, that is, the photo-transistor, is actuated by the reflected light from the light barrier and applies the consequent 10 kHz signal to a ×80 amplifier via C5. The capacitor and the input resistance of the amplifier form a a high-pass filter. The collector of T1 has a d.c. potential of 3 V. Capacitor C8 and diode D1 cause a d.c. shift, so that at the anode of D2 positive pulses with a width of 60 µs are present. These pulses charge C9 via D2 and R9. If sufficient pulsating light is reflected as, for instance, when the paper is less than 15 mm from the light barrier, the voltage across C9 is sufficient to switch on T2. The output signal is then taken direct from the collector of T2 via the relay (do not forget D3).

The circuit draws a quiescent current of about 30 mA and an operational one of around 80 mA, excluding the relay current. ■