This experimental circuit board was designed and built as a development aid for those constructors who wish to design their own parallel printer add-on boards. The author used the prototype board whilst experimenting with digital to analogue converters (DACs) and liquid crystal displays (LCDs) amongst other things.

Hardware design & software: Adrian Grace

LPT exerciser

gateway to the PC parallel port

The board of which the circuit diagram is shown in **Figure 1**, connects to the standard 25 way ‘D’ connector of the computer’s parallel port via a 25 way ribbon cable, and is terminated on the circuit board with a transition connector (see the relevant construction notes). The design itself comprises of three circuits — one for each of the registers (DATA register, STATUS register and CONTROL register) associated with the parallel printer port.

Registers

First, a quick word about the registers. The DATA register is an 8 bit output latch which is normally used to transfer data to the printer. The STATUS register has 5 readable inputs and is used by the computer to ‘monitor’ the status of the printer for error messages etc. The CONTROL register has 4 outputs, and is normally used to control the functionality of the printer.

Data register

The 8 outputs of the data register are connected to 8 LED’s (D5-D12) via current limiting resistors (R5-R12). The LEDs themselves are 5mm wide by 2mm thick and fit comfortably into the traditional 2.54mm grid pattern.

Status register

The status register has 5 inputs which are simulated via a DIL switch. The inputs are as follows:

D7	D6	D5	D4	D3	D2	D1	D0
Busy	Acknowledge	Paper out	Select	Error	Unused	Unused	Unused

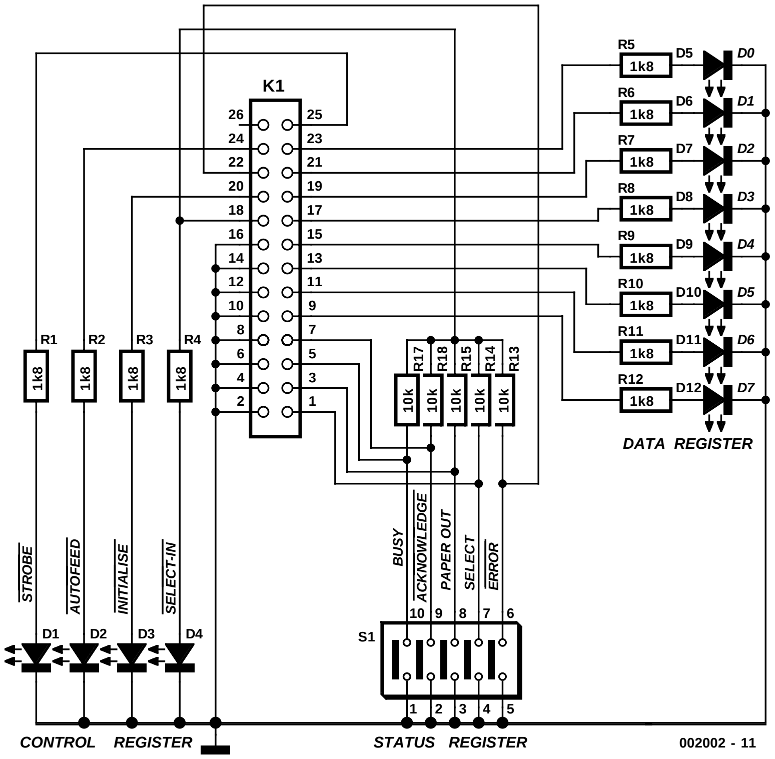

Figure 1. Circuit diagram of the LPT board.

The switch contacts are pulled up via resistors (R13-R17) and their status can be read providing the SELECT IN, bit D3 of the control register is at a logic high. This allows the board to become self powered — i.e. batteries not required.

Control register

The control register is 4 bits wide — lower nibble. Each output is connected to an LED via a current limiting resistor in a similar manner to the data register outputs. Indeed, the LEDs should have the same packaging but preferably a different colour. The function of each bit is shown below:

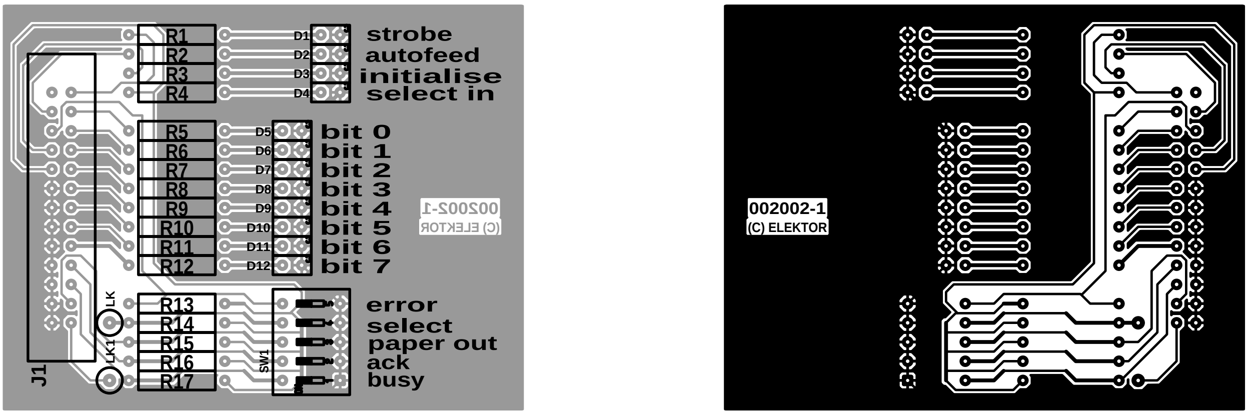

Figure 2. PCB artwork designed by the author.

D7	D6	D5	D4	D3	D2	D1	D0
Unused	Unused	Direction	IRQ	Select In	Initialise	Autofeed	Strobe

LED D4 has a dual purpose, when it is energised it provides power to allow the switch positions connected to the status register to be read.

The upper nibble of the control register contains some control bits which are not addressed in this design.

Construction

The Ultiboard design files of the PCB designed by the author for this project may be found on diskette **006002-1** which is available through the *Elektor Electronics* Readers Services. Population of the board is straightforward, see **Figure 2**. Fit all components on the circuit board except for J1. Don't forget the link. J2 can be fitted to the ribbon cable at this point — after the extra 'way' has been removed, of course, as a 26-way ribbon cable won't go into a 25-way connector! The coloured leader stripe on the ribbon cable (which identifies pin 1) should be aligned with pin 1 on J2.

Now comes the fun bit. Lay the circuit board in front of you so that the position of J1 is furthest away from you. Lay the ribbon cable over the top of the circuit board so that the free end of the ribbon cable is at the J1 position. The ribbon cable should be orientated so that the leader stripe is on the right hand side. OK so far? Slide the ribbon cable into the transition connector J1, so that there is an empty space on the right hand side, and the left-hand side fits snugly against the edge of the connector. J1 can now be squeezed onto the ribbon cable – make sure that it is fitted squarely. This is easy to do if you use a couple of pieces of scrap 'veroboard' on top of each other to protect the pins of J1. Finally flip the ribbon cable over and fit the strain relief clip. J1 can now be soldered onto the circuit board.

Software

The software associated with this design is available on the above mentioned diskette with order code **006002-1**. It has been written in 'C' and is suitable for running under DOS. As you can see in **Figure 3**, the program itself (executable file) is menu-driven. The program will first of all interrogate the computer's BIOS to establish the printer port address and display it on screen. At present, the program will only look for the first port LPT1.

The main menu displays three options, one for each register and an exit path.

The first option is for the STATUS register. With this option, Select In is automatically actuated, allowing the switch positions to be read. The hex value of the switches is displayed on screen until a key is pressed on the keyboard.

The second option is for the DATA register. When selected, a second submenu is displayed along with the present value of the data register. The submenu allows the user to shift bits left or right and increment or decrement the register values. The register value is written out to the parallel port so the bit patterns can be viewed on the LEDs.

The third option is for the CONTROL register. This option just cycles a moving LED up and down the four LEDs associated with the control register — until a key is pressed as before.

Diskette **006002-1** contains the original source code and the intermediate object file as well as the executable file. The source code is highly commented and you are at liberty to experiment with it — that's how I learnt how to write it.

COMPONENT LIST

D1-D4 = 5mm x 2mm LED, high efficiency, green
D5-D12 = 5mm x 2mm LED, high efficiency, red
R1-R12 = 1kΩ8, 0.25W
R13-R17 = 10kΩ, 0.25W
SW1 = 5-way DIL switch
J1 = 26-way TRANSITION connector, plus strain relief clip.
J2 = 25 way MALE IDC ribbon connector
26 way ribbon cable, cut to length with one 'way' removed.

If you intend to go on and experiment further with your own designs connected to the parallel port, **it is strongly suggested that you obtain a 'cheap' secondary LPT port board**. This will prevent you from damaging your main parallel port, which is usually integrated into the motherboard. Damaging your motherboard is not a good idea!

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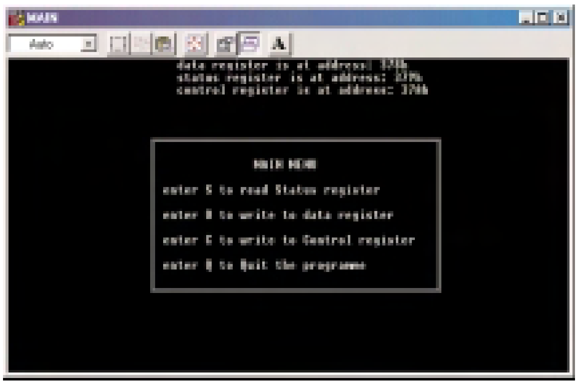

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data register is at address: 378h
status register is at address: 379h
control register is at address: 37Ah

MAIN MENU

enter S to read Status register

enter D to write to data register

enter C to write to Control register

enter Q to Quit the programme
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Figure 3. Screen dump showing some of the options offered by the program.