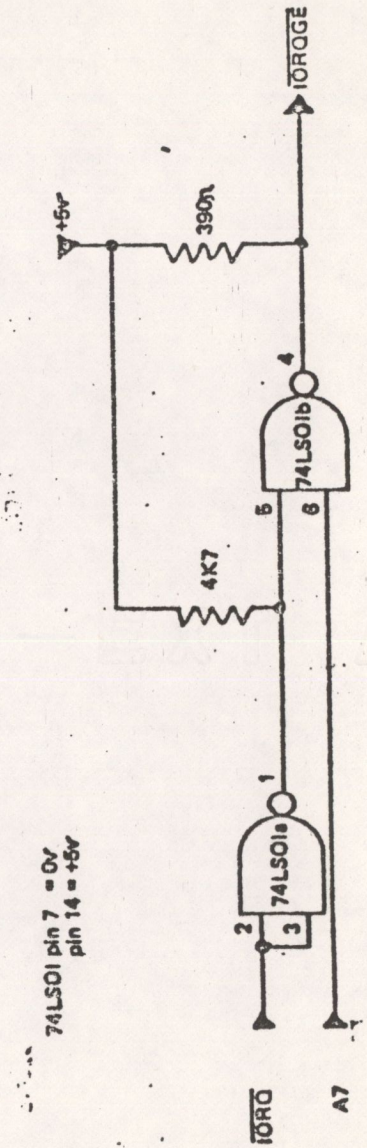

15. ADDING A Z80A PIO CHIP

This parallel input/output chip enables the Z80A CPU to communicate with the outside world. In this chapter a brief explanation of how the PIO works, how to program it, and how to connect it up to the rear edge connector will be given. It is not intended to give a complete and fully detailed description of the PIO chip. This information can be readily obtained from specialised books on Z80 interfacing. Chapter 18 contains details of an 8 channel analogue voltage to digital output converter as a practical example of a useful device which can be run from the PIO. One of its many uses is for reading the X and Y coordinates from a joystick input.

The Z80A PIO chip has been designed specifically for use with the Z80A CPU chip. If you look at the pin connections in fig. 11a you will notice lots of familiar signals. There is the databus for fully bidirectional communication with the CPU, the clock, $\overline{M1}$, $\overline{IORQ}$, $\overline{RD}$ and $\overline{INT}$ signals all being connected directly to their equivalent pins on the edge connector. There are also two pins for the "interrupt enable input" and "interrupt enable output" signals. These are only of relevance when interrupts are being used. The basic use of interrupts are to force the CPU to run a specified piece of machine code program. For example, the Spectrum might be running BASIC and also be under use as a central heating controller. The CPU doesn't want to waste time keeping a check on the house temperature (from a signal from a thermostat) because this would slow down the BASIC. We would therefore use interrupts. If the temperature gets too high or too low anywhere in the house the thermostat circuit would interrupt the CPU which is then forced to run the central heating program. When this is completed it can go back to BASIC and forget about the heating until it is interrupted again.

Looking at the other connections you will see that there are two I/O ports. These are designated port A and port B to distinguish between them. Each port has 8 I/O lines (PA0 — PA7 and PB0 — PB7) and two handshake lines (ARDY, $\overline{ASTB}$ and BRDY, $\overline{BSTB}$). In this book only the eight I/O lines will be used. The other signals are used in BYTE data transfer modes between input/output devices (usually of different computers).

In order to illustrate the PIO chip programming there follows a practical example with explanation. The object is to define PA0 to PA1 as inputs and PA2 to PA7 as outputs. It will then be seen how these can be used by the CPU to operate the switches and lamps circuit. This example uses port A, however port B can be used in exactly the same way by sending control words and data words to port B instead. The circuit shown in fig 11b should be built on the same board as the PIO chip. The 74LS05 integrated circuit is used to operate the light emitting diodes (LED's) because the PIO chip outputs cannot supply enough current. Virtually any type of LED can be used in this circuit.

If you have a 16K Spectrum then the Spectrum's own +5 volt power supply should be sufficient to operate all of the circuits in this book. 48K Spectrum owners may find that their +5 volt power supply just cannot provide sufficient current for their extra 32K of memory plus the additional circuits given here. If you find this to be the case with your Spectrum, an additional +5 volt power supply will be required. A suitable design is discussed in chapter 3.