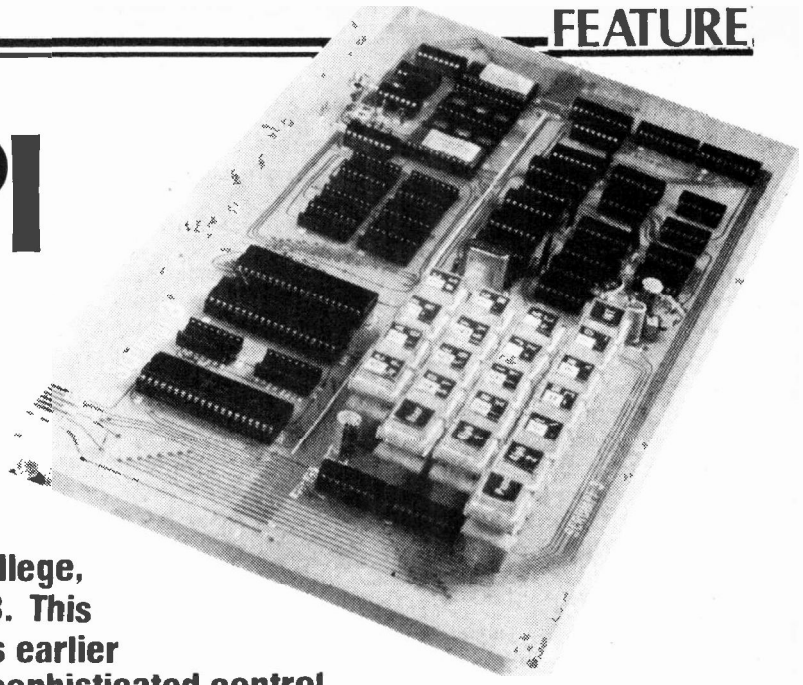
SCRUMPI 3



Justin A. T. Halls, of Queen Mary College, takes a look at Bywood's SCRUMPI 3. This kit is an improvement over Bywood's earlier LED switch kits but is still seen as a sophisticated control device rather than a personal computer. The kit also provides an excellent introduction to the worlds of MPUs.

Srumpi 3 is the cheapest currently available microprocessor kit with full alphanumeric input and a VDU type display. It is the successor to the Scrumpi 1 and 2, switch and LED kits and is based on the same MPU, National Semiconductor's SC/MP. The kit also provides facilities for cassette and teletype interfaces.

Scumpi 3 is built on a 380 X 190mm printed circuit board, with plated through holes and a clearly component overlay. High quality, low profile sockets are provided for all the ICs and two 16 pin DIL sockets are provided for access to the 16 I/O ports and the UART. Access to the TTY interface is via four pins at one side of the board, while power supply lines, reset line and video signal are taken to an eight way, 0.1'' edge connector. A UHF modulator is mounted on the underside of the board and provides a signal suitable for most 625 line TV sets via a standard phono socket. Data and address busses are not directly available, but test points are provided at either end of the board. Imput is via a 21 key keyboard, made up of good quality switches with transparent key caps, beneath which are fitted self-adhesive labels identifying the key functions.

Three main chips are the sc/mp ii, which has the advantage over the SC/MP 1 of being faster and requiring only a single +5 V power supply, the INS8154 RAM I/O, which contains 128 bytes of memory and provides 16 individually addressable I/O ports, and the AY-5-1013 UART. Two EPROMS, protected from accidental erasure by opaque labels over the quartz windows, hold the 512 byte monitor program and 512 bytes of user accessible I/O routines, A 7MHz crystal provides a clock from which are derived the VDU control signals as well as a 3.5 MHz clock for the MPU and a 15 kHz clock for the UART. The video interface circuitry occupies nearly half the board and uses the 8675bwf character generator to provide the full 64 upper case ASCII characters in white on black or black on white, either of which may be selected as standard and which may be mixed on the screen.

Data sheets are provided for the MPU and RAM I/O chips and two handbooks provide assembly and operating details. An SC/MP pocket instruction guide is also provided. The user has to provide a +5 V, −12 V power supply plus a 7.5V supply for the UHF modulator. It is also necessary to drill holes in the PCB to take mounting pillars if the kit is to be fitted in a case, or take legs if the kit is to be used naked. A reset switch is also needed.

Getting It All Together

Actual construction of the kit was quite straighforward, although the instruction manuals tended to be reminiscent of some car technical manuals, with instructions like 'all sockets, capacitors, resistors, diodes, links and keyswitches can be installed at this point', and the crystal and one of the ICs are never mentioned at all. One component that did cause some problems was the UHF modulator. The position of this is not marked on the board and the connections to it are not indicated. A phone call to Bywood confirmed that this does in fact fit beneath the board, the mounting pins having to be filed down to fit the holes provided. If the kit is not fitted in a case the presence of the modulator beneath the board means that legs must be fitted to enable the board to sit squarely on the table when in use.

When fitting the 21 keyswitches care must be taken as the holes for them are not too accurate and bending the pins too far to make them fit could damage the switch. Since many of the tracks run very close together, care should also be taken with the soldering and it is a good idea to leave the kit overnight after assembly and then re-checking very carefully for the presence of solder splashes or bridges.

To minimise the possibility of damage to delicate and expensive ICs and to ease trouble-shooting, the chips are inserted sequentially, checks being made at each stage to ensure that one part of the circuit works before proceeding to the next. Apart from TV synchronisation problems most of this setting up procedure was very simple, although some statements were a little misleading and a great deal of time was spent won-

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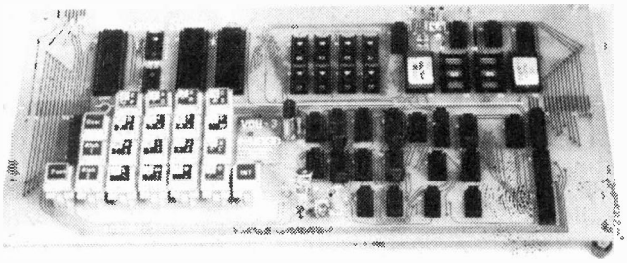


The assembled Scrumpi 3 kit. The system's firmware is resident in the two EPROMs seen top left with their protective labels. The three presets we had to fit to get the video levels right can be seen bottom centre.

dering why the address decoding wasn't decoding before we found that the NWDS line had to be earthed first. It is in cases like this that a circuit diagram would have been invaluable. The use of the INV line as a test probe was very clever and useful; if the line is taken to logic 1, the screen remains the same, but if taken to logic 0 the screen inverts (i.e. black characters on a white background instead of white on black).

Pictures Galore

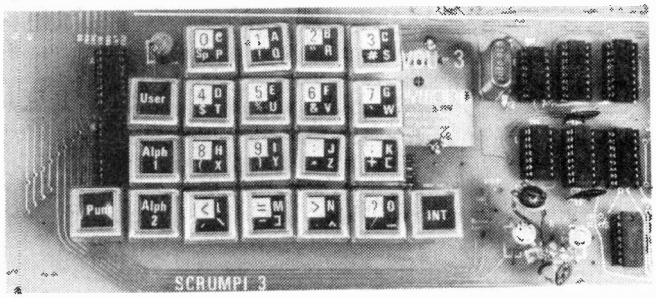
The video circuitry is basically quite simple, with a 7.02 MHz clock driving a series of dividers and a handful of gates. Two MM2112, 256X4 RMs hold the picture in a memory mapped display. The rest of the video circuitry simply consists of the character generator and a number of buffers.

The UHF modulator is pre-tuned to channel 36 and merely needs connecting to the aerial socket of a TV set. It can be run from the on-board + 5 V line, but with some sets better resolution, especially when displaying black characters on a white background, is obtained by running the modulator from a separate supply of about 7.5 V. A simple, unregulated battery eliminator, set at 6 V (actual output about 7.5 V) is sifficient.

The Bywood errata sheet points out that some video monitors or converted TVs require a 4 V pk-pk video signal rather than the 1.5 V pk-pk signal provided by the kit, and that this can be obtained by adjusting the values of R3-R5. We had great difficulty in obtaining a stable picture and eventually had to resort to replacing the riesistors with 470R presets; even now picture stability is not as good as it might be and it is continually necessary to adjust the vertical and horizontal hold controls. It is quite possible however that these difficulties are due to the use of a cheap portable TV which may well not be set up correctly. No problems have been found with these modulators in other applications.

Key Features

Bywood have managed to squeeze all 64 upper case ASCII characters onto a 21 key keyboard. This is achieved by the use of three shift keys. One soon gets used to using the shift keys and although it would be more convenient for entering hexadecimal code if the lower case characters were 0-9 and A-F, the current layout has presumably been chosen to ease use as a general purpose teletype.



Close up view of Scrumpi's keyboard. By using the various shift functions this keypad can provide a full alpha-numeric set.

Getting In And Out

The teletype interface, supplies and receives a 20 mA current loop and is therefore compatible with many types of TTY. Control of this interface is purely by software, using the SC/MP 'flag 0' for output and 'sense B' line for input, each bit being set or sensed individually, with a delay instruction being used to set the bit rate to 110 baud or whatever rate is required. Unfortunately, details of sending and receiving routines are not supplied, although these should not prove too onorous to write.

Parallel I/O is provided for by the INS8154 RAM I/O chip which also contains the 128 bytes of RAM supplied with the kit. 16 I/O lines are available and these may be configured as two independant eight bit ports designated A and B, each of which may be specified as an input or an output port. This provides for very versatile interfacing with the outside world.

For these who prefer a serial interface however, an AY-5-1013 UART is provided. The rate at which data is output or received by the UART is determined by an extemal clock, this being set to sixteen times the desired baud rate. In the Scrumpi 3, the 15.625 kHz line frequency for the VDU is used, providing a baud rate of 960 (not 9600 as stated in the manual). If a more standard baud rate is desired, the internal clock can be disconnected and an external clock provided via one of the I/O sockets; 4 800 Hz will give 300 baud suitable for a cassette interface, while 1 760 Hz will give a rate of 110 baud. No details are given of how to use the UART, but these have been published in ETI (Dec. 1977).

All of these various I/O lines, except the TTY 20 mA loops, are available from two 16 pin DIL sockets. Each socket is provided with + 5 V and ground connections, as well as the UART transmit and receive lines and the MPU 'sense A' line, used by SC/MP for software interrupts. In addition socket A has the eight bits of port B, reset, and the UART clock, while socket B looks after the eight bits of port A. Unfortunately the INTR line from the RAM I/O chip, which is used in handshaking routines, is not available, but it could be connected to an unused pin on one of the sockets, as could the serial input and output lines from the SC/MP which are also unavilable.

Where Its All At

The kit comes with 128 bytes of RAM (not counting the 256 bytes used by the VDU) of which 64 bytes are