

# ACORN COMMUNICATOR OFFICE WORK STATION

By Roger Cullis

In the wake of ICL's unexpected success with One Per Desk, Acorn unveils a new micro with ample comms facilities which could appeal to an even wider market.



Conceived as a general-purpose solution to other people's problems, the Communicator is the first of a line of products designed to meet the needs of original equipment manufacturers (OEMs). It will not be sold directly to the public by Acorn. Instead, different versions will be produced for specific requirements and will carry the customer's own logo.

The Communicator has been designed from scratch as a state-of-the-art communications engine. It is enclosed in a sleek, low-profile case and has a telephone handset with full push-button dialling mounted at the left-hand side. The width of the housing was determined by the need to accommodate a full QWERTY keyboard, an eight-key cursor pad and a numeric keypad. An additional row of keys provides help and soft reset, eight function keys, and mode switching between telephone, calculator and computer operation.

The keyboard has a firm feel, comparable to later versions of the BBC Micro. Soft

## Comms are supported by the basic hardware and operating system.



encoding is employed so that it can readily be reconfigured. It also contains integral links which can be interrogated by the main processor for identification so that, for example, the Communicator can recognise whether it has a standard or an Arabic keyboard, an important feature in a machine

## SPECIFICATION

**CPU:** Western Design Centre 65816  
**Memory:** 128K or 512K dynamic RAM, 32K battery-backed CMOS RAM, four 128K ROMs

**Ports:** RS-423 serial and Centronics parallel, fully buffered expansion socket, RGB/composite video LCD interface; optional viewdata expansion card

**Telephone facilities:** line-powered handset, autodial modem

**Display:** colour monitor, optional LCD

**Sound:** integral speaker

**Mass storage:** none built in; available via Econet file server providing twin 600K 3.5in. floppy drives or one floppy and one 10Mbyte hard disc

**Price:** end-user price likely to be in the range £1,000 to £1,500, according to configuration

**Supplier:** Acorn Computers Ltd, Fulbourn Road, Cherry Hinton, Cambridge CB1 4JN. Telephone: (0223) 245200

**Availability:** to OEMs only

likely to be used for remote communications.

Positioned at the right-hand edge is an expansion connector with a full 24-line addressing capability to permit the addition of peripherals. Approximately 8Mbyte of the processor's address space is available for use by the peripheral. Bolt holes are provided so that the auxiliary unit can be coupled rigidly to the main housing.

The first of these add-ons is to be a logic-controlled microcassette unit which incorporates a loud-speaking telephone, and is equipped for unattended phone answering and for dictation. It provides facilities such as automatic dialling from an address book, electronic mail, telex and teleconferencing.

Display is normally provided by a monochrome or colour monitor driven by RGB or composite video. Maximum resolution is 640 by 320 pixels. There is also a socket and interface for a liquid crystal display, which may be selected from small units for auxiliary applications or full A4 size where it replaces the CRT monitor. Other forms of display, such as plasma discharge or electro-luminescent tubes, could be offered as an alternative.

In addition to the telephone line, there is an RS-423 interface. Instead of the usual D-connector this uses a standard British

## PREVIEW

(continued from previous page)

Telecom jack socket. It supports full bi-directional communications and operates at data baud rates of up to 19.2Kbaud, selected under software control. A Centronics interface is provided for printer connection, and an Econet interface for a local area network.

The standard unit has no file-storage facilities; archiving is accomplished by way of the Econet file server. Acorn has designed a smart 1.2Mbyte twin double-density 3.5in. disc-drive unit for this purpose, controlled by what is, in effect, a built-in cut-down BBC B + Micro with 6512 processor, 1770 floppy-disc controller, 64K of paged ROM and 64K of RAM. It has a Centronics interface and printer-server firmware which permits the spooling of files for printing. The filing system is Acorn's standard Advanced Network Filing System (ANFS), which supports a hierarchical file structure with up to 47 files per directory.

### HARD DISC

An Acorn 20Mbyte hard-disc unit may be connected to the disc unit via a 1MHz bus connector; alternatively, one of the floppy drives may be replaced by a 3.5in. hard-disc unit. The file server incorporates its own battery-powered clock to provide automatic date and time stamping, and which can also act as the network clock. On reset, the file-server operating system searches for an external clock, and if it does not find one it installs its own.

The size of the main printed-circuit board, and hence the number of facilities which could be provided on the basic unit, is constrained by the footprint requirements of the external housing. The motherboard

follows normal Acorn practice and is a high-quality four-layer PCB.

The main innovation is the 65816 processor which drives up to four socketed 128K ROMs, two banks of dynamic RAM and 32K of CMOS RAM with battery backup. The dynamic RAM may be in the form of 64K or 256K chips to give from 128K to 512K of core store. Eventually, 1Mbyte chips could permit this capacity to be further extended, but for the time being additional memory can only be provided by means of an expansion unit. A switching power supply derives d.c. voltages from the 21V a.c. input. There is a single 6522 versatile interface adaptor (VIA) chip for serial and parallel I/O.

The entire left-hand side of the PCB is occupied by an autodial modem, providing pulse or tone dialling and operating entirely under software control. A battery-backed clock serves as a calendar and time-of-day indicator. A large ULA chip controls the video display and keyboard circuitry and acts as a sound-cassette modem.

The standard video display emulates BBC

modes 0 to 6 only, since there is no 5050 teletext chip. A monochrome version of the BBC's mode 7 is, however, emulated in the mode 0 display. To provide full-colour teletext the computer may be fitted with a software-controllable Super Teletext daughter board, complete with UHF input and tuner, which plugs into a connector on the motherboard. Screen memory occupies half of one 64K bank of the 65816 address space. The LCD interface supports a 256-by-64-pixel screen, which may be a window of the main display or totally separate.

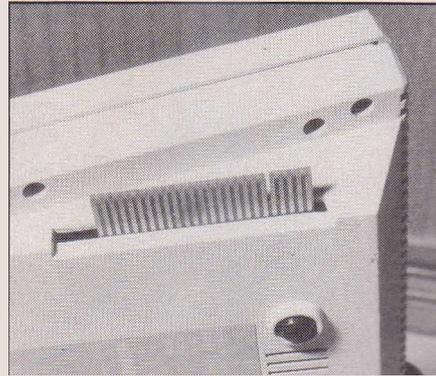
### BBC SOFTWARE

The 65816 chip has an eight-bit 6502 emulation mode and shares many of the 6502 instructions and addressing modes. It has therefore been possible to use the software of the BBC Micro as a starting point, since the code could quickly be translated to 16-bit format. The current version of the operating system permits a task to be interrupted and then resumed after an intermediate task has been executed, but this will shortly be replaced with a full multi-tasking operating system which supports foreground and background tasks and a windowing facility.

The Communicator is supplied with the 1983 65C02 version of BBC Basic. There is also an option of the View Suite ROM, which provides a comprehensive range of applications software: VT-100 emulation is also available. For the benefit of its OEM customers, Acorn has prepared a comprehensive set of instruction manuals as well as full 65816 software-development tools.

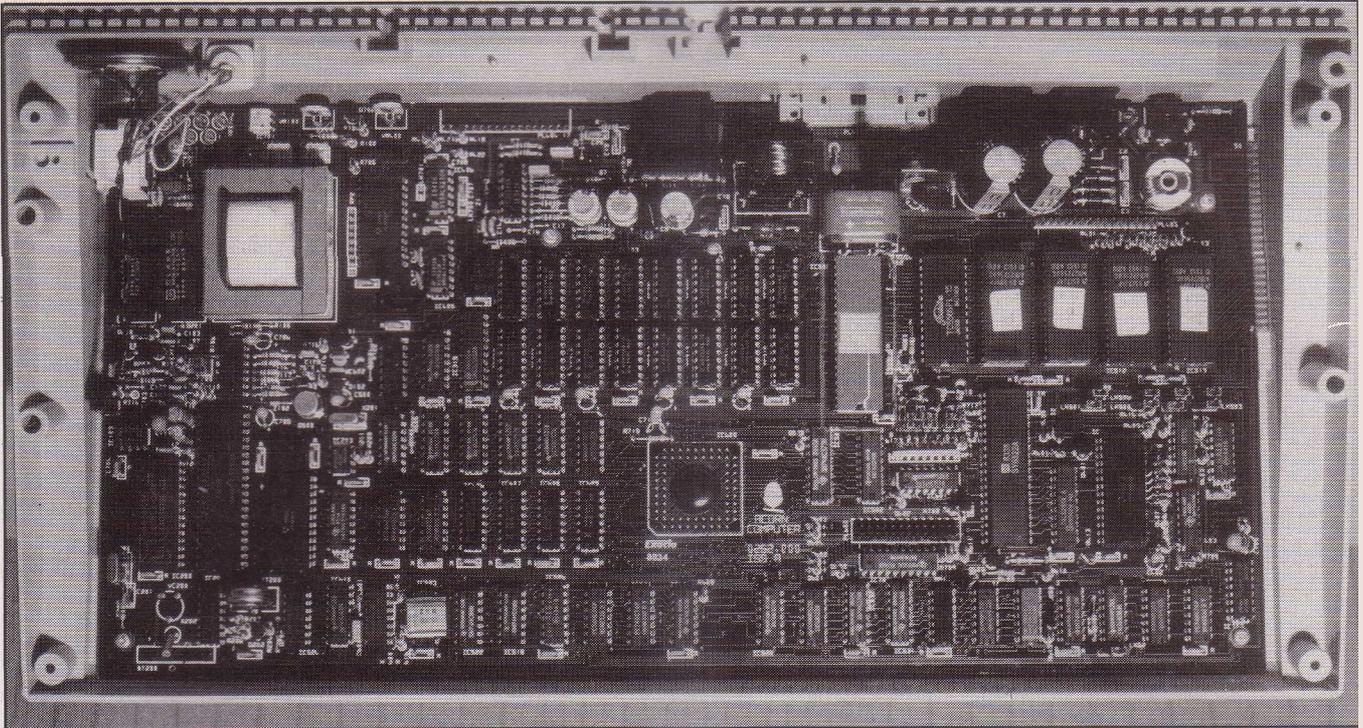
### CONCLUSIONS

- Definitely a must for the Yuppy. Users such as information providers, government departments and service industries will also find it invaluable.
- I hope Acorn's Consumer Division at Newmarket Road will be one of the OEMs to apply its logo. Educational users would welcome with open arms the large memory space and networking facility.
- Acorn has once again shown that it can produce a good basic machine with plenty of development potential, but 512K of RAM may be limiting in a multi-tasking environment.



Above: Full provision for add-ons.  
Below: Several LCD screens can be





## THE 65816 CHIP

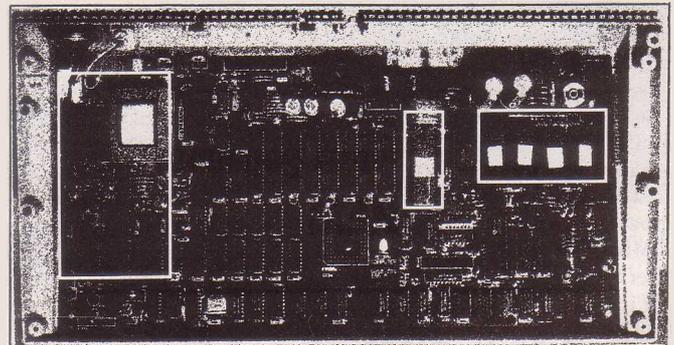
One of the problems with a rapidly advancing art, such as computing, is that each new step presents a dilemma: should you make a fresh start with a clean slate, or should the existing system be upgraded. With the Intel series of microprocessors, there has been a clear upgrade path. The eight-bit 8080 gave way to the 16-bit 8086 and eight/16-bit 8088; these were in turn replaced by the 80186 and the 80286 and will be followed, in due course, by the 80386. In each case, the instruction set and programming techniques of the new chip were compatible with those of the predecessor, so that new software could be written by adaptation and development of that which already existed.

This option has not hitherto been possible with systems based on the 6502. Although there are family relationships with the eight-bit 6800 series and their successors, the differences are sufficiently marked to make it necessary to go back virtually to square one and start again. Memory expansion of 6502-based systems has been achieved by techniques such as bank switching and RAM-disc simulation.

The introduction of the Western Design Centre 65816 has changed matters, since its instruction set is a superset of the 6502's and it can operate in a 6502-emulation mode. Like the 8088, it is a full 16-bit microprocessor internally, but the external data bus is eight-bit. It is housed in a 48-pin dual in-line package which is pin-compatible with the 6502.

Eight-bit operation is adequate for many data-processing applications — in particular those not involving floating-point mathematics — but one major drawback of the 6502 is its limitation to a 64K address space, the result of its having only 16 address lines. The 65816 overcomes this problem by having a 24-bit address bus, which gives a direct addressing capability of 16Mbyte. This is made possible, while retaining the 6502 48-pin encapsulation, by multiplexing the additional eight address lines with the data bus.

The internal register structure is based on 6502 architecture, with 16-bit registers substituted for eight-bit registers. Programming compatibility is achieved by structuring the address space in 64K blocks and providing further eight-bit extensions to the program counter and index registers for bank selection. The new direct register extends the concept of zero-page addressing, by providing a start address for the direct page anywhere within bank 0. The accumulator and index registers can operate in either eight-bit or 16-bit mode, selection being made by



As is standard Acorn practice, the Communicator's single PCB occupies the full area of the casing. Its most significant innovation is the use of the 16-bit 65816 CPU chip, highlighted in the diagram above just off-centre. The 65816 has a 6502 emulational mode, so the Communicator starts life with a ready-made software base. Up to 512K of ROM is supported (highlighted at the right of the board). The main PCB also carries full comms hardware, including an autodial modem (highlighted left).

appropriate flags in the status register. A ninth flag, E, indicates whether the processor is acting in 16-bit mode or is emulating a 6502. This flag cannot be accessed directly, but can be swapped with the carry flag for read or write purposes.

Like that of the CMOS 65C02, the instruction set of the 65816 permits direct transfers between the index registers and the stack. There are eight instructions which permit new types of stack access. Five of these transfer data to and from the stack and the other three transfer computed data to the stack or pull it to one of the registers. Instructions are provided for direct control of the hardware: the COP instruction supports co-processors and STP stops the system clock. Provision is made for block moves with MVP and MVN, which move data higher or lower in memory.

The 6502 supports vectors at FFFE-F for IRQ/BRK, at FFFC-D for Reset, and at FFFA-B for NMI. The 65816 supports three further vectors: at FFF8-9 for Abort, at FFF6-7 for BRK in 16-bit mode, and at FFF4-5 for co-processor routines. The 65816 extends the 6502 addressing modes to accommodate 24-bit addresses and 16-bit data, where appropriate, and expanded stack addressing modes are provided for the new stack-manipulation instructions.