

Acorn 
The choice of experience
in networking.

LOCAL AREA NETWORKING **ECONET**

The introduction of Econet to Acorn's range of microcomputer products proved a significant advance in communication for the BBC Microcomputer. The benefits gained by linking individual microcomputers were considerable – increased productivity, greater efficiency, lower capital costs and for the individual user a much enhanced working environment. In the educational field Econet offers a wealth of opportunities for both staff and students. Econet is used for research and development, micro-related courses, and individual project work, as well as being a valuable classroom resource for demonstrations and seminars. Econet is one of the most widely used networks – there are now more than 6000 installations throughout Europe. Five years of experience have ensured a well supported,

reliable network with all the versatility necessary for such a variety of users. There is a large number of authorised Econet dealers throughout the country to give you expert advice, professional installations and support for your network. With Acorn Computers' continuing commitment to local area networking and its new range of advanced microcomputers – the BBC Master Series – the potential of this economic yet reliable network reaches out further than ever before.

In general, networking means three things – sharing hardware, sharing information and fast communication between users.

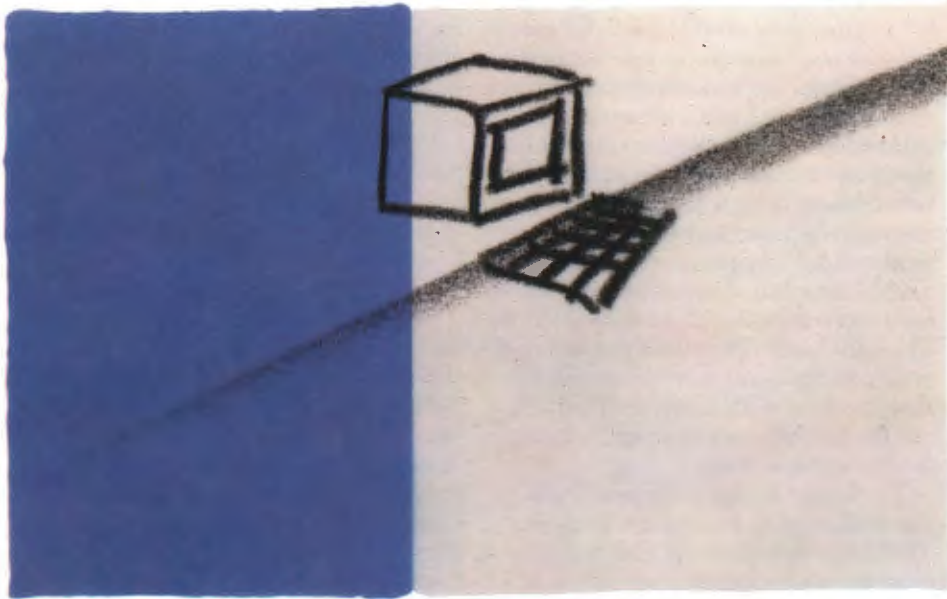
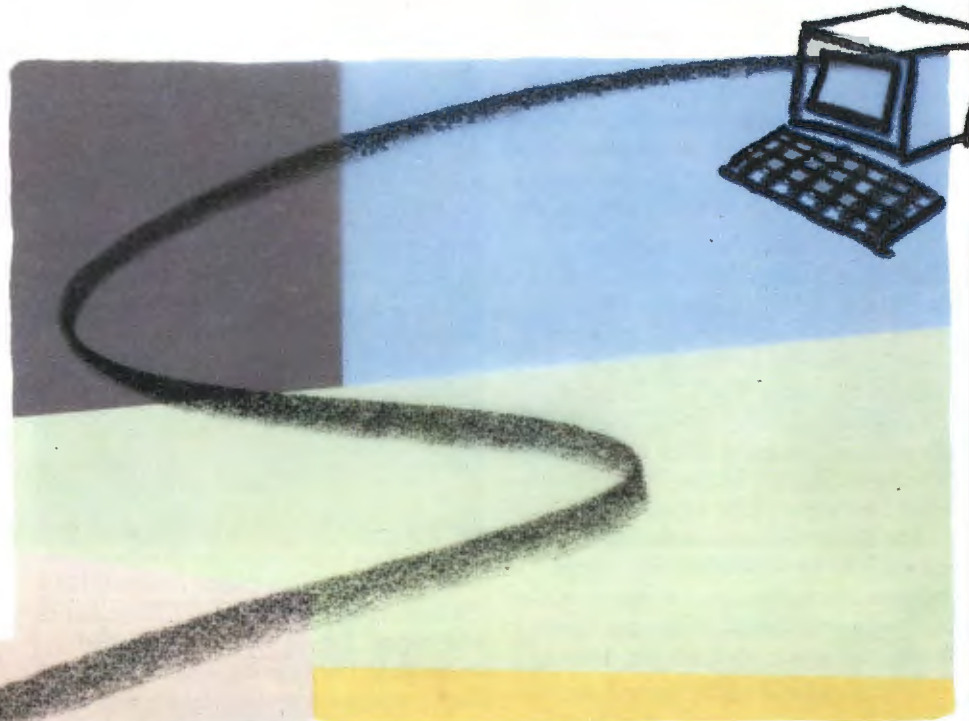
A simple microcomputer system consists of monitor, processor, keyboard and data storage device. A printer is needed for producing hard copies of documents,

reports and letters. A vital but costly piece of equipment, the printer will stand unused much of the time. The microcomputer next door also needs a printer, as does the one down the corridor, and so by linking them together, the micros could all share the same printer. For an individual microcomputer a Winchester hard drive is another costly and often underused peripheral. Again, networked micros can share expensive disc drives, which have far more capacity than the individual user normally requires, to make the entire system far more economic.

Networking offers a more efficient use of hardware. It offers even greater advantages in the sharing of information. Gaining

access to a file or program is simply a case of calling it up from its location on the network. Those programs allowing simultaneous access give consistently up-to-date information to any authorised user. Not all information is for sharing; security can be built into the network in the form of user passwords.

A further advantage of networking is communication with others, from the exchange of short messages between users to longer and more permanent communications, such as memos sent by electronic mail.



LOCAL AREA NETWORKING

The versatility of Econet offers a variety of choices in configurations. Here is an introduction to some of the hardware designed with your needs in mind.



THE MASTER TURBO FILE SERVER

The combination of co-processor, language and system architecture enables the Master Turbo to achieve execution speeds for interpreted BASIC programs which are faster than virtually any other personal computer. The CMOS-based Co-processor operates at twice the speed of the standard processor. With a 30 Mbyte Winchester disc the Master Turbo provides a fast, high capacity file server.

The file-server station is dedicated to running the file-server software, a large program which manages the storage of files on the chosen medium. There are three levels of file server, each offering different facilities to the network user.

THE MASTER ECONET TERMINAL WORKSTATION

Designed specifically for networking environments, the Master ET includes the Econet interface card and associated connector and the latest Advanced Network Filing System (ANFS) software.

Not every workstation on the network needs its own printer, disc drive or software as these resources are shared with other machines. Therefore the Master ET can do without many of the interfaces needed by stand-alone machines, making it most economic without losing any of the processing power of the Master Series.

However, if access to local peripherals is required, the Master 128 can be used.



File Server

Workstation

Bridge

Such a station can alternate between the use of local or network facilities as required.

Licensed software can be loaded via the network to the sideways RAM and applications cartridges can be inserted directly into the cartridge sockets of the machine.



THE MASTER 128 PRINTER SERVER

A Master 128 fitted with an Econet interface card functions as a printer server. The printer-server software is installed as a memory chip in a sideways ROM socket of the station. Printer serving is not a dedicated task. The printing goes on in the background and so the machine may also continue to function as either a workstation or file server.

THE ECONET STARTER KIT

The starter kit comprises a number of components to join the stations in a network. Two terminator units are used to prevent reflections on the line and, to provide signal conditioning, the cabling must be properly terminated. The clock unit generates a signal to synchronise data transfer on the network. The clock unit and power supply take minimal power and may be left permanently connected. Leads are supplied to connect the clock unit to the middle of the Econet cable. Three socket boxes are included for use in per-

manent installations. Any number of sockets can be fitted on the cable for computers to be plugged in or out at any time. As with the terminator units the sockets are fitted with insulation displacement connectors for quick and easy attachment to the network without the need to break and resolder cables. Detailed fitting instructions are provided in a complete installation guide supplied with the starter kit.

THE ECONET BRIDGE

The Econet Bridge extends the flexibility of the network still further. Where network usage is intensive and/or covers a wide geographical area, the Bridge provides a high speed automatic connection between Econet networks for communication and transfer of data. Several networks can be joined together, thus creating smaller networks for distinct user groups and giving greater reliability. Should one network failure occur, it would not affect other networks bridged to it. The introduction of a number of further bridges increases the possible layouts to meet most needs, thus providing fast, reliable network services which are both flexible and economic.

The Econet Bridge is connected with standard cables to the required network. The Bridge then monitors both networks receiving any messages for re-routing.

File and printer servers can be accessed on remote networks via the Bridge.

THE ECONET X25 GATEWAY

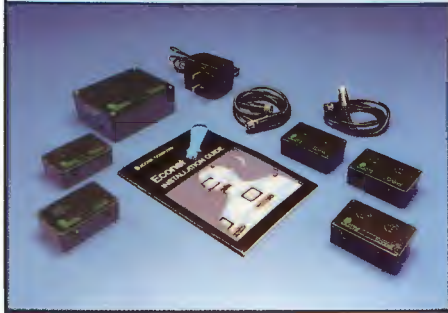
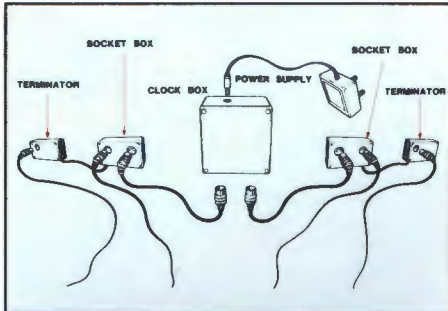
With communications playing an important role in any network, the X25 Gateway provides an important link with the other off-site terminals, thus facilitating file transmissions and giving remote access to other networks or mainframes. As many as 16 stations on the Econet network can use the Gateway at any one time.

The X25 Gateway uses the International Standard for this communication with both public and private data networks.

SOFTWARE

There are three levels of file-server software: levels 1 and 2 use floppy discs, whilst Level 3 is installed on an Acorn Winchester hard drive. The more advanced levels of file server, 2 and 3, provide many facilities for interaction between workstations and file server and between other workstations. Level 3 file server also comes with a sophisticated Viewdata system and sample database of Viewdata pages.

The effectiveness of your network will, to a large extent, depend on the software available. With Econet's increasing popularity, many software houses are now involved with applications packages specifically designed for use on Econet. There are over 500 titles currently available for use on Econet. They are listed in the *Third Party Educational Catalogue* published by Acorn Computers.



GETTING STARTED

All the components needed to start up your network of microcomputers are supplied in the Econet Starter Kit. A main cable runs the length of the network with a terminator box at each end. The clock box is sited in the middle whilst each workstation is connected by a socket box.

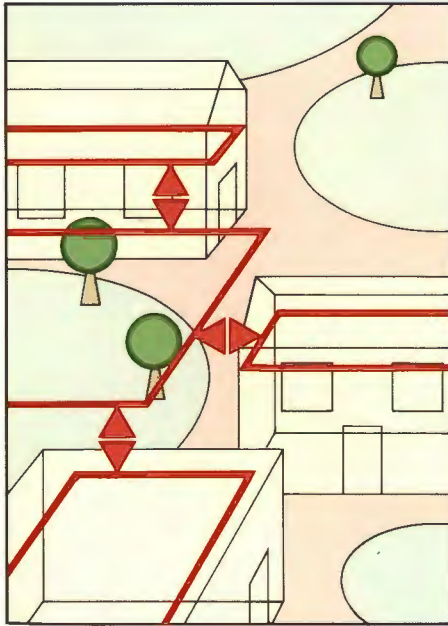


FILE AND PRINTER SERVERS

Interaction with the file-server station is only required when starting up or closing down the network. During Econet operations the file-server station provides the user stations with shared access to the selected storage medium. The file server's monitor registers the actions of the individual network stations. The printer-server station can be accessed from any of the other stations on the network, or from stations on other networks if linked by Econet bridges. This allows expensive printer facilities to be instantly available from any workstation.

SITING BRIDGES

To maintain maximum efficiency a single network should be within 500 metres. To overcome this constraint bridges are used to join two or more networks. Connected in this way, it is possible to use file servers, printer servers and other resources on other networks. To join two networks, their identities are set using the two rows of links to the left of the circuit board inside the box. Each network is assigned individual numbers in the range 1-127. The bridge box is then connected by DIN plugs to a normal station socket on each network.



PLUGGING IN THE STATIONS

When all the components of the starter kit have been connected and tested it is simply a case of plugging in the network stations. Each machine is plugged into a socket or terminator box, reset and the network filing system (NFS) selected. A station can be plugged in or out of a network at any time without affecting other stations or the general network operation.



Given the versatility of Econet, its use is best demonstrated with examples of actual applications. From the following descriptions you will begin to see how Econet can work for you. These user case studies point to Econet's invaluable qualities. It is reliable, economic, versatile, powerful and expandable.

Lady Margaret Middle School

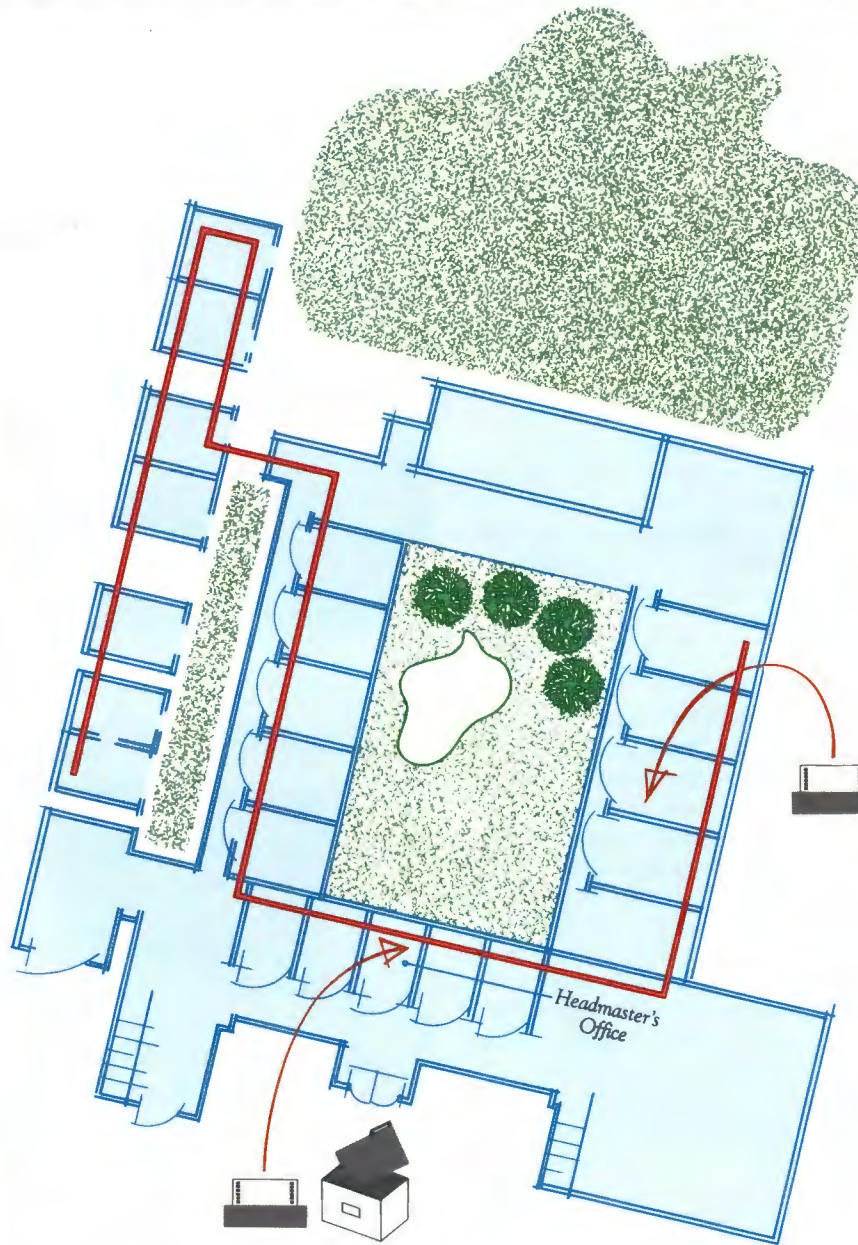
The Econet network at Lady Margaret Middle School (featured in a survey of Local Area Networks in Education published by the Council for Educational Technology) has been installed to cover 25 rooms spread over 300 metres and including three external buildings. The school has 13 computers which can be used in any of the rooms and which access a 10 megabyte Winchester file server.

The school has concentrated on making sure the computers are available and useful on a daily basis and each child is given space on the system on joining the school. Each morning the children, aged between 8 and 12, are supplied with a new page of information and news, followed by a menu of software. Software available includes word processors, databases and a turtle LOGO. The messages and communications facilities of the network encourage students to find out more about the use of the network. The system of passwords ensures, however, that pupils cannot corrupt or alter programs to which they should not have access.

The network also provides important cost savings. Additional stations can be added as funds become available without having to purchase any new peripherals such as printers or disc drives.

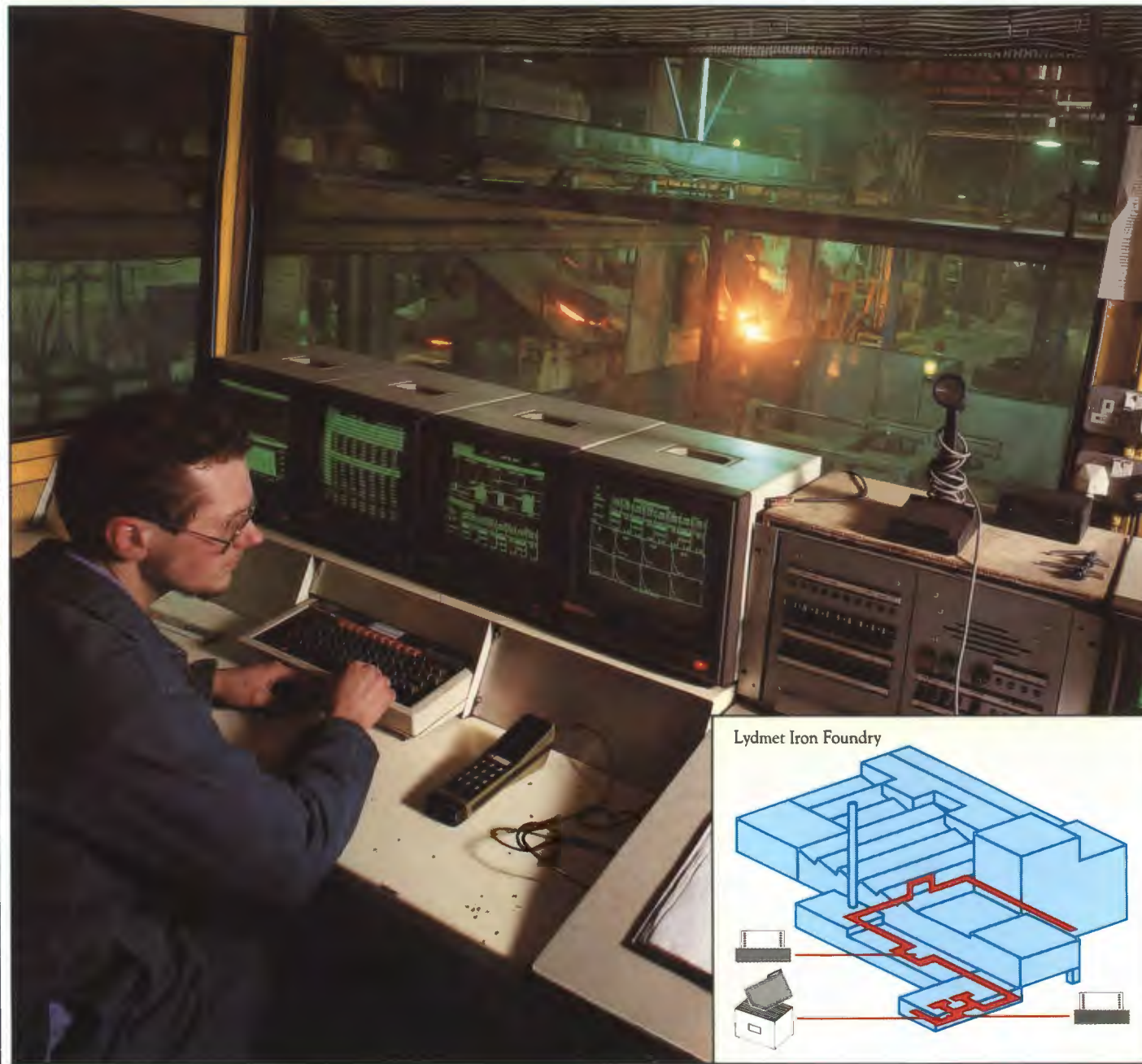
'We have been using the Econet for two years and would not be without it now. We find that the computers can be integrated into the curriculum as a tool which generates interest and work away from the keyboard. The Econet contributes to this by ensuring that the tools the children will use are available in any classroom. This generates a feeling of support and sharing throughout the school.'

- Mrs Grant, Lady Margaret Middle School, Southall



Lady Margaret Middle School





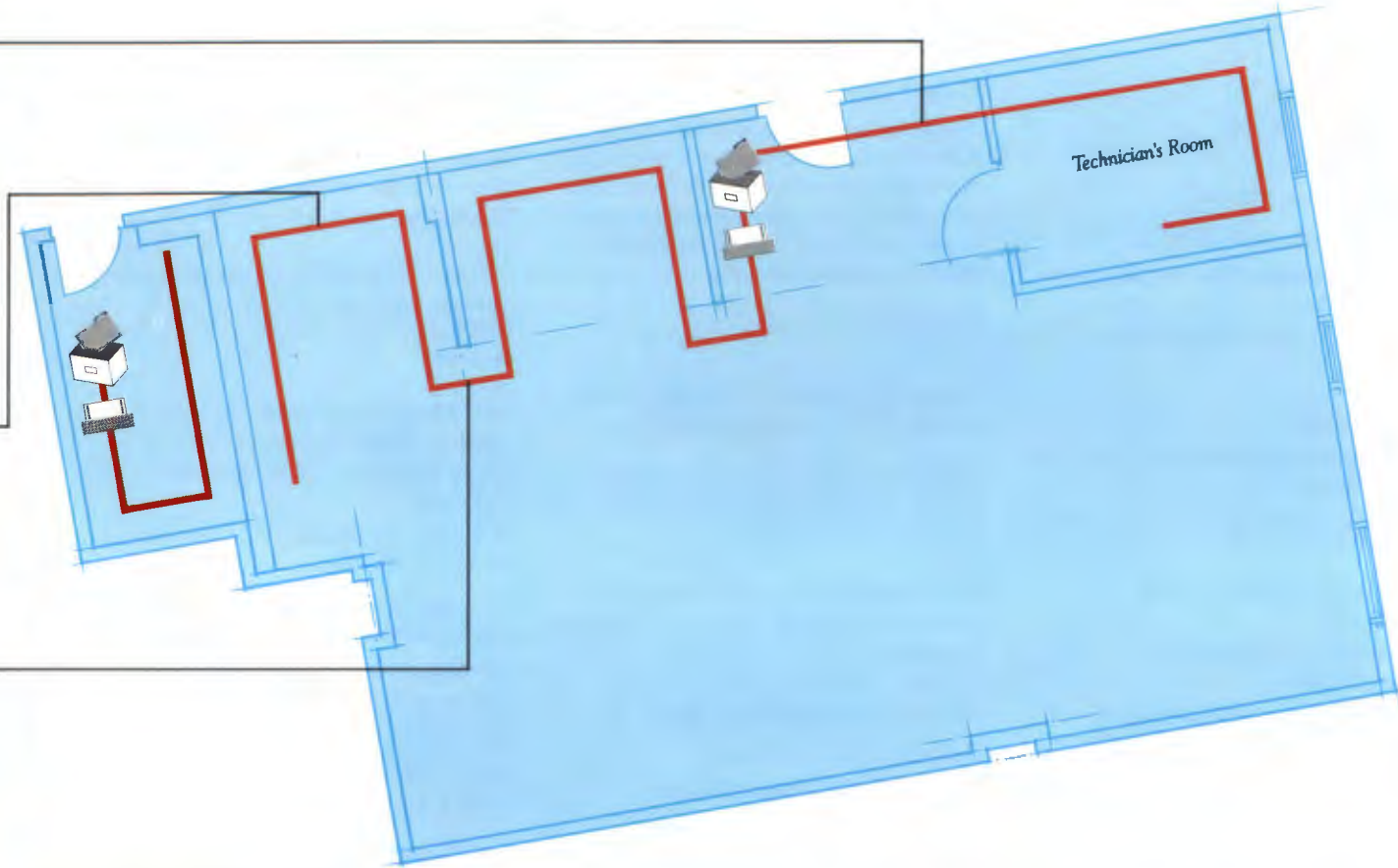
Examples of Econet's use in industry and training can be taken from a wide variety of sources. Here we have highlighted two applications. At Lydmet, Econet is used for monitoring and control along with management of information. The training aspect is well demonstrated by the example of St George's which illustrates the efficient use of the network in administering a wide variety of tasks.

Lydmet Iron Foundry

Lydmet Ltd is a foremost supplier of special valve-train components and castings to the motor industry, particularly camshafts. An extensive Econet system has been a fundamental part of the technical management of the foundry process since 1984. All data from the main production line computer is written to an Acorn Winchester file server, forming the basis of the management system. During the manufacture of castings, important process parameters such as metal chemical composition and ladle pouring temperatures are constantly monitored and automatically integrated into the file-server database.

The Econet network also provides on-line data for display on a battery of screens in the foundry control room which is the key to the overall plant control. This enables Lydmet to be one of the few foundries meeting the latest motor industry quality standards which incorporate statistical process control (SPC) requirements. Additional screens, from shop-floor work areas to the managing director's office, provide instant access to all relevant data.

The Econet system offers a highly reliable and cost-effective factory-monitoring facility proven in a hostile environment and provides an essential tool to controlling both quality and costs at Lydmet.



St George's District School of Nursing

St George's District School of Nursing

The audio-visual aids department of the School of Nursing has two Econet systems in use. The main network is used for nurse education and consists of a Level 2 file server providing 800 Kbytes of shared disc storage to 11 stations set out in two adjacent bays of a large room. The printer-server system is also installed in the file-server machine.

The department particularly likes the use of the network system because the software (32 main programs, 70 files) can be left running on the file server all day. This means that the software is instantly available to any station on the network. As the intention is to provide education and training packages on nursing subjects, it is an advantage not to have to teach in excess of 500 students about the care and use of floppy discs. The use of the network is also less distracting than having a disc drive at each

station; it leaves more desk area available, and it is cheaper than purchasing a disc drive for each computer.

A wide variety of software is kept on the file server for teaching, self-testing and revision on a range of nursing subjects and those related to patient care. All the programs have been linked together by means of a simple menu program. This ensures that students have easy access to any program available on the two discs.

The second network of six stations is used

mainly by teaching staff for software development, testing new programs and word processing. They hope soon to enhance the 11 station network by adding a 30 Mbyte Winchester Level 3 Econet file server.

'We have been in contact with a number of other colleges and schools of nursing, some of which have, and others are considering, purchasing Econet systems for their own nurse education work after seeing our system running.'

- Richard Butler, nurse and software author

Econet Network

Type: CSMA/CA

Topology: Bus

Speed: Baseband 250 kbit/s

Maximum single network length: $\frac{1}{2}$ km

Maximum number of stations per network: 254

Maximum number of interconnected networks: 127

Workstations

Master Econet Terminal (128 Kbyte RAM, 64 Kbyte ROM)

Master 128 (128 Kbyte RAM, 128 Kbyte ROM)

Master Turbo (196 Kbyte RAM, 132 Kbyte ROM)

BBC Model B (32 Kbyte RAM, 32 Kbyte ROM)

BBC Model B+ (64 Kbyte RAM or 128 Kbyte RAM, 48 Kbyte ROM)

Acorn Cambridge Workstation 443 (4 Mbyte RAM, 112 Kbyte ROM)†

Cambridge Co-processor module for Master 128, BBC Model B (B+) (1 Mbyte RAM, 16 Kbyte ROM)

Note All models listed above except the Master Econet Terminal and the Acorn Cambridge Workstation must be fitted with an Econet interface before they can be used on the network.

A user guide describing Econet services is included with each Econet workstation.

†*Level 2 and 3 file servers only*

Level 1 File Server

The Level 1 file server provides simple shared access to disc storage for the storing and loading of programs. The Level 1 file server has in most cases been superseded by the Level 2 and 3 versions, which considerably enhance facilities.

Level 2 File Server

EQUIPMENT REQUIRED:

Master Turbo fitted with Econet interface module, 800K dual floppy disc drive

or

Master 128 fitted with Econet interface module, 800K dual floppy disc drives, 6502 Second Processor

or

BBC Model B (B+) with Econet interface, 800K dual floppy disc drives, 6502 Second Processor

INCLUDES:

File server software (floppy disc)

Econet Level 2 User Guide

Econet Level 2 Manager's Guide

Level 3 File Server

EQUIPMENT REQUIRED:

Master Turbo fitted with Econet interface module, 10Mb or 30Mb Winchester (800K dual floppy disc drive*)

or

Master 128 fitted with Econet interface module, 10Mb or 30Mb Winchester (800K dual floppy disc drives*), 6502 Second Processor

or

BBC Model B (B+) with Econet interface, 10Mb or 30Mb Winchester (800K dual floppy disc drives*), 6502 Second Processor

**Necessary for installing the network, backing up files and archiving*

INCLUDES:

File server Level 3 software on floppy disc

Viewdata system software on floppy disc

Battery backed real time clock module fitted with rechargeable battery

Level 3 File Server Initialisation Guide

Level 3 File Server Manager's Guide

Starter Kit

2 terminator units

Terminator method passive

1 clock unit

Clock signal asymmetric, frequency selectable

Power supply and connecting lead

Cable

Dual twisted pair

Characteristic impedance 100 ohms \pm 10%

Mutual capacitance \leq 66pF/m

Propagation speed $>$ 0.5c

Connection by solderless IDC sockets, 180° 5 pin DIN

3 socket boxes (for permanent installations)

Cable insertion tool

A Complete Guide to Installing Econet

Econet Bridge

ABS Plastic Case

L 350mm, W 206mm, H 72mm

2 MHz 6502 Second Processor

8K RAM

8K ROM

Dual Econet interface

Self-test mode

INCLUDES:

2 connecting leads

Installation Guide

Printer Server

Printer server software (ROM)

Printer Server Manager's Guide

Factsheets

Further factsheets on the following are available from Acorn Computers:

Econet Bridges

X25 Gateway

Econet Software

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DEALER

In this brochure, the initials BBC refer to the British Broadcasting Corporation.

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