A Basic Guide to

DATA
COMMUNICATIONS

This booklet is an introductory guide to the various services which are now available for transmitting text and documents over telecommunications networks. It is one in a series of basic guides to telecommunications produced by OFTEL in conjunction with the independent Advisory Committee on Telecommunications for Small Businesses (known as **BACT**).

New techniques for transmitting information and improvements to existing ones are constantly being developed. This booklet mentions some of the latest innovations but mainly concentrates on the tried-and-tested methods widely available at the time of publication (September 1993). The services discussed are those likely to be of most interest to small businesses. All prices quoted in this guide were correct at the time of publication.

Copies of the other booklets in this series - *Does Your Business Need a New Telephone System?* and *A Guide to Cellular Radio* - are available, free of charge, from OFTEL, 50 Ludgate Hill, London EC4M 7JJ (tel: 071-634 8754, fax: 071-634 8943).

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1 THE SPOKEN OR PRINTED WORD?

The telephone is an easy-to-use, personal and 'instant' form of communicating. However, there are occasions when the information you want to communicate is long, complex or very detailed. A phone call could lead to errors or misunderstanding and a letter would be too slow. The result might be a loss of goodwill or business. On other occasions the person you wish to speak to urgently might be unavailable and you are not confident that a message would either get to them in time or be sufficiently accurate. There are also circumstances where the person you are speaking to needs some form of paper copy.

If your business relies upon fast, accurate exchanges of information, it could well benefit from the use of one or more of the text communication systems such as facsimile (fax), electronic mail or telex which send messages over telephone, data and telex lines. These will enable you to send paper copies of text and, in some cases, drawings within minutes.

The purpose of this booklet is to describe briefly the services that are currently available. As well as pointing out the strengths of particular services, it also warns of their potential weaknesses. The aim is to help you decide which is likely to offer the greatest benefit to your business.

2 WHAT IS AVAILABLE?

There are several ways of sending text and images electronically. The most popular are:

FACSIMILE (FAX)
Currently the fastest growing service with over 1 million machines in use in the UK and about 20 million worldwide. Fax overtook telex internationally in 1986.

ELECTRONIC MAIL (EMAIL)
Email has flourished with the boom in the use of personal computers and small portable computers. At present there are several systems in use in the UK and the total number of customers is believed to be about 170,000.

TELEX

Until 1986 the most widely used method of data communication.
Currently there are over 100,000 users in the UK and about 2 million
worldwide.

COMPUTER-TO-COMPUTER

This is an increasingly popular option when both the sender and the
recipient have a computer attached to either the public telephone
network via a modem (see page 18 and Glossary) or a digital
network.

Each of these methods of communication depends on using one or more of
the public telecommunications networks (telephone, telex or data) operated
by British Telecommunications plc (**BT**), Mercury Communications Ltd
(**Mercury**) and Kingston Communications (Hull) plc. If you use the telephony
services of your local cable company, fax and email will be available but check
on telex. In addition, it is also possible to use fax and email systems over the
normal mobile (cellular) networks operated by Vodafone Ltd (**Vodafone**) and
Telecom Securicor Cellular Radio Ltd (**Cellnet**) and a number of mobile data
networks now offering service. Data can also be sent to people within your
organisation over trunked Band III PMR (private mobile radio) networks.
You can use a combination of the mobile and fixed networks for transmitting
data but you should check for compatibility of networks and the equipment
you propose using on the networks. It is possible that you will be able to use
fax and email systems over many of the newer forms of telecommunications
networks which the Government has already licensed or is considering
licensing in the future.

You should note that in some cases your telephone line might be of perfectly
adequate quality for voice telephony but you might experience difficulty with
data or fax transmission.

All telecommunications systems - from simple domestic telephones to
complex business networks - connected to public networks must be run
under a licence. However, you need not apply for your own because nearly all
are run under a **class licence** (either the Telecommunication Services Licence
or the Self-Provision Licence). One of the requirements of the class licence is
that you must use only approved apparatus in your system. As discussed later
in this booklet, you may feel your best solution is to use bureau services.

However, if you wish to acquire your own apparatus, you must ensure that it is approved for connection to the relevant telecommunications network (telephone line, data line, telex line or private circuit as appropriate).

Normally, approved equipment is marked with a 'green circle' indicating that it has been approved by the British Approvals Board for Telecommunications (BABT) for connection to public telecommunications systems. Some items, particularly those intended primarily for business use, do not have to display a 'green circle' although they are approved. In addition, many non-speech 'add on' items - such as data terminals and computers - which are connected to the public network via another item of apparatus, such as a modem (each model of which has to gain approval), are approved under a General Approval granted by OFTEL on 29 December 1986. These 'add on' items are deemed to be approved for certain uses by a declaration from the manufacturer and, although they do not bear an individual approval number, you can check with the supplier that they have been approved under the General Approval procedure.

Further information on this is given in OFTEL Update **SA6** which is available, free of charge, from OFTEL's Library, 5● Ludgate Hill, London EC4M 7JJ (tel: 071-634 8764/5).

In addition to the main services described in this booklet, there are many more specialised options available in data communications, for example access to remote database facilities and EFTPOS (electronic funds transfer at point of sale) facilities. These are beyond the scope of this booklet. Data communications is an area where the pace of new development and innovation has been particularly rapid over the last few years. The options available are constantly evolving and new services being offered. The basic choices available will now be discussed in more detail.

3 FACSIMILE (FAX)

Fax machines can be described as 'communicating photocopiers'. Both text and diagrams can be transmitted using a normal telephone socket and line.

Although it is possible to use your existing telephone line for your fax machine, for most businesses it is advisable to rent a second line from your public network operator for fax purposes. The main reason is that you cannot

make or receive calls when the fax machine is operating. This can be annoying for your customers and especially so if you forget to switch the line back to the telephone and they find themselves trying to talk to a fax machine - at their own expense!

Some fax machines have a switch which recognises whether the incoming call is fax or voice and will automatically route calls accordingly. If your fax machine does not have this facility you can purchase a switch box to install between the network terminating point (usually the master socket which divides your telephone system from the outside line) and your fax and telephone to do the same thing. If you find you seldom use either the telephone or fax machine this could be a cost-effective solution but it is advisable to have a telephone answering machine connected to your telephone line in order to offer a complete message receiving service. There are fax machines on the market which combine the features of a fax, telephone and answering machine and will automatically switch incoming calls to the appropriate function.
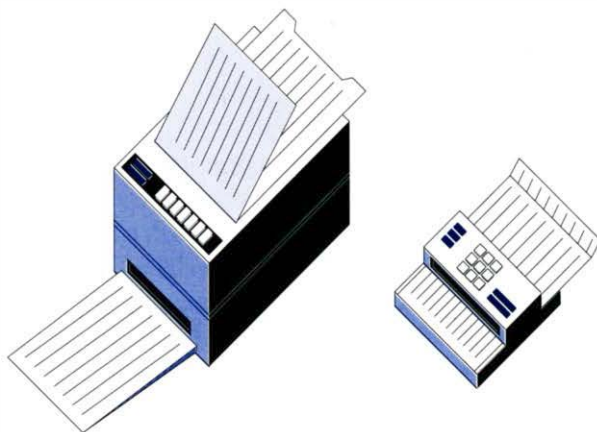
Another option now available is to use your personal computer as a fax machine. To do so you need an approved fax modem, in addition to a telephone line. Fax modems are available as either an internal card for your computer, or a small portable unit (this can be battery powered for small portable computers), or a large box (separate mains switch required)(see page 7). Appropriate software for the computer is usually supplied with the fax modem. This option could allow you to use a single personal computer for all your data communications needs, including email, telex and direct computer links.

If you retain a single line and connect a fax machine and other pieces of approved equipment to it (eg extension telephones, answering machines), you should check that the total REN (ringer equivalence number) does not exceed 4, otherwise your fax or telephones or other equipment with a 'bell' may not ring. Most basic telephones have a REN of 1 and the simple fax machines a REN of 1 or 3.

If you choose to have a separate line for your fax machine, it is your responsibility to let your network operator know which of your lines has a fax machine connected to it, otherwise their directory information will be incorrect. BT will publish your fax number in local Phonebooks for no extra charge.

Most modern fax machines incorporate a Mercury button for easy access to the Mercury network for long-distance calls. Your Mercury PIN Code can be programmed into the Mercury button on the fax machine. So if you are a Mercury subscriber check that the model in which you are interested is Mercury compatible or install a Mercury Smart Socket (£85.10 plus VAT) on the line you dedicate to fax or modem use - in which case your equipment does not have to be Mercury compatible.

Operation

Fax machines are usually quite simple to operate. You feed the document which you wish to send into a slot on the side or front of your machine, dial the telephone number of the fax machine you wish to copy your documents to and press a transmit button either when you have finished entering the number or when the remote machine responds. If you are using a telephone handset in conjunction with the fax machine then you press the transmit button when you hear the remote fax machine. Although a less convenient mode of operation, using a handset does give you a check on whether the number you have called **is** a fax machine which can be very useful if your fax machine has failed to get through before.

Most machines enable you to stack several sheets into the slot. Each sheet is transmitted in turn and ejected into a tray (see illustrations). There is a slight delay before the first sheet is transmitted while the two communicating fax machines 'handshake' in order to determine the correct transmission speed (see page 10).

Your fax machine receives messages and prints them out either onto thermal paper or plain paper (see below). Always ensure that your fax machine has an adequate supply of paper ready for incoming calls, especially to cover the time your office is unattended.

If you have a fax modem on your personal computer you can transmit faxes instantly without having to produce a paper copy first. This saves on staff costs as your staff do not have to spend time printing out the document and going to the fax machine, which may have a queue, and also on paper costs. Another advantage is that if you have a computer network in your office, faxes can be sent from any workstation. However, you cannot transmit material, such as photographs, not stored in the computer. As for receiving faxes, the only advantage the fax modem has over a separate fax machine is a saving on paper costs. The fax modem receives documents as a bitmapped
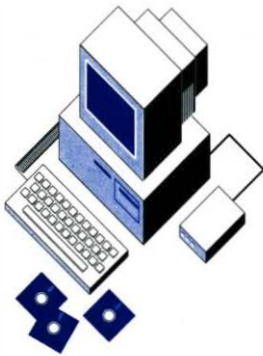
External fax modem
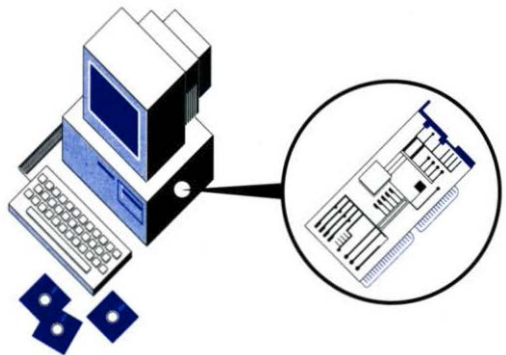
Internal fax modem circuit board

image of the page sent by the remote fax machine - ie your computer does not recognise individual images as particular letters or characters. The text image can therefore be viewed on your computer and printed out but not edited using the keyboard. To recover the original text for editing, this file has to be fed through an optical character recognition (OCR) package which converts the images into keyboard characters. However it might not interpret some characters correctly if there is any interference on the line. Diagrams (either computer generated or scanned in) can also be sent and received but may take up a great deal of computer memory. Some fax modems do not incorporate any form of fax reception and some receive incoming faxes at a slower rate than they transmit. Most fax modem software will allow you to

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send or receive faxes while carrying out some other task on the computer. A visual or audible alert for incoming faxes is usually incorporated.

It is very easy to misdial when sending a fax as there is no obvious difference between a telephone and fax number - they are interchangeable - unlike a telex number. Always double-check that you are dialling the correct number, especially if you are reading it off a letterhead, list or advertisement. Your fax machine is unlikely to warn you that the number you have dialled is not connected to a fax machine. Your customers might get very annoyed if rung up by a fax machine - especially if they discover you are the culprit!

Cost of fax machines

Fax machines come in all shapes and sizes and in a very wide range of prices. Essentially you get what you pay for but over the last few years prices have come down dramatically. Small portable fax machines are commonplace and, like portable computers, can be acoustically coupled to telephones at little cost. Prices for these start at around £300 and many machines costing less than £500 incorporate features such as an automatic fax/telephone switch, paper cutter, local copy function, built-in answerphone, number memory allowing speed dial numbers, up to 10 sheet document feeder and limited polling (see Glossary).

For more substantial robust standard machines, you can expect to pay upwards of £1000 depending on the features you need. These can handle larger documents and have more memory capacity. Features can include fast transmission speed, automatic send and receive, delayed transmission, automatic retry for failed calls, error control, stored databases, polled line operation and mail box facilities.

Fax machines using plain paper (rather than thermal - see below) for copying are becoming very popular and now account for at least a quarter of the new machines being sold and about 5% of the number of fax machines installed in the UK. These are more expensive but running costs can be slightly lower (see below). There are several types of technology used, the most expensive being laser fax machines which start at about £1500. The cheaper machines are based on ink jet technology and start at around £900. However the ink jet machines tend to be rather slower than most other types of fax machines, including thermal paper models. Apart from the convenience of using any sheet paper, one advantage of plain paper fax machines is that the quality of

reproduction of graphics and images, and the print quality generally, tends to be far superior, especially on laser faxes.

Most types of machine can be rented or leased. However, you might be offered a 'fax plan' where capital and running costs are amalgamated into a single 'cost per copy'. These arrangements have led to misunderstandings over actual costs and you might be better advised to buy a machine outright or opt for a straightforward leasing arrangement.

Fax modems, enabling you to use your personal computer as a fax machine, cost around £400 or more depending on the features you require. The small portable (or 'pocket') fax modems start at around £200. The fax modem must be BABT approved (see page 4). You must check carefully that the fax modem you purchase is fully compatible with your computer system and software.

Running costs - line charges and maintenance costs

The next consideration is the running cost. If you choose to have a dedicated line for the fax machine you will have to pay the connection and rental charges to your network operator. When your machine is transmitting, the call charges are exactly the same as for voice telephony but bear in mind that long documents can take some time to transmit. You can save money by delaying transmission of non-urgent faxes to take advantage of off-peak call rates if your fax machine has this facility. Although fax machines are becoming increasingly robust and reliable, a heavily used machine needs regular maintenance and it is therefore worthwhile considering taking out a maintenance contract with your chosen supplier at the outset. This could ensure a quick service when you do have a problem.

Running costs - thermal versus plain paper copying

Documents received by your fax machine are normally printed onto special coated paper - known as thermal paper - which costs a few pence a sheet. The process works through a chemical reaction on the special heat sensitive paper. The drawbacks with this method are that it makes the paper shiny and flimsy, difficult to write on and, more importantly, the image is likely to fade after a time. You should photocopy these faxes or store them in a cool, dark place if you wish to retain them for any length of time. Another problem is that thermal paper is supplied in rolls and, in the case of some older fax machines,

messages running over several pages are printed out in one unbroken stream of paper which then has to be cut up into manageable lengths.

Plain paper copiers use any sort of office sheet paper, loaded in the same way as a photocopier. The faxed messages do not fade. This can lead to considerable paper cost savings. However you must also bear in mind that there are additional running costs incurred for items such as toner. Some laser fax machines use an all-in-one cartridge which includes the drum and toner. Others use all separate components. Drum yields may vary considerably from 10,000 to 60,000 impressions so the cost may not be considered to be a 'running cost' for the higher yield models. The consumable items are often supplied only by the manufacturer so are not as competitively priced as thermal fax paper which is available from a number of sources.

Speed of transmission

Over the years, in order to increase the speed of fax transmissions, three different standard speeds have evolved through international agreement. These are known as CCITT Groups 1, 2 and 3. Group 1 machines take about 6 minutes to transmit an averagely filled A4 sheet of paper and are now virtually obsolete. Group 2 machines take about 3 minutes and Group 3 machines about 30 seconds to transmit the A4 sheet. Diagrams slow down the speed.

The speed of fax transmission is governed by the speed at which the receiving fax machine can operate. Obviously the faster the machine, the lower the call charges, but in practice, most machines now available are Group 3 types. Check this when you obtain your fax machine. A Group 3 machine can normally communicate with a Group 2 or Group 1 machine but the transmission will proceed at the slower speed. The quality of transmission is affected by the quality of the lines over the public network(s). A Group 3 machine will automatically drop down to a reduced speed if transmission at the higher rate proves unsatisfactory. Transmission quality over the public networks has improved as digital technology has replaced analogue.

If your business regularly needs to transmit large volumes of messages and information at high speed, you might consider using the public data networks or ISDN services (see page 21). Group 4 category fax machines can *only* be operated on the data networks *not* on normal telephone lines - these can transmit an A4 sheet in an average of 2 to 3 seconds. In addition to the fixed

networks, there are now also companies offering mobile data networks. Alternatively you could consider a fax service (see below).

Fax services

Many organisations, including high street print shops, offer a public fax service for anyone who does not possess a fax machine of their own but would like to be able to have documents transmitted quickly from time to time. Some may be prepared to receive incoming messages for you. Consult your local Yellow Pages, Thomson and other local directories for details.

Some companies - for example, Mercury (Surefax), BT (FeatureFax), Cellnet and Vodafone - offer various fax delivery services. Subscribers transmit a message to the service and the service then automatically manages the onward transmission of the message, incorporating company coversheet and logos, to any number of destinations (these could be a pre-stored list of clients).
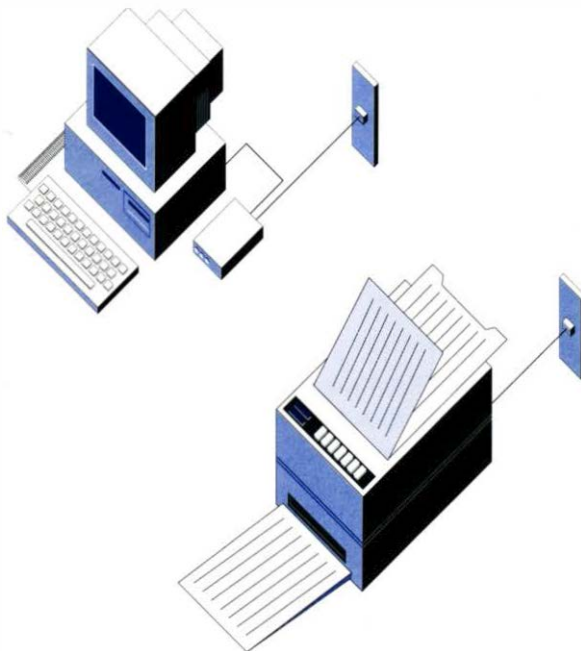
Onward transmission can be immediate or delayed (to take advantage of cheaper call rate periods) as the customer requires. Some services allow you to transmit material directly from your personal computer to the fax service.

These services could be a cost effective way of sending out multiple faxes if you need to do so often because they can reduce queues for the office fax machine, cut down the amount of staff time spent on the task and reduce the duration for which your fax machine is engaged. They also ensure end-to-end transmission by automatically retrying engaged lines and incomplete calls or trying alternative numbers.

As an example of cost, the Mercury Surefax service, which operates via a switch installed between your existing fax machine or personal computer with fax modem and the outside line, costs £1.60 per socket per month plus £5 per month subscription for each machine and a one-off registration fee of £10 per machine. In addition there are call charges which are fully itemised with the Mercury service.

Security

In general, fax machines do not offer the same degree of security as telex or email. This is because, in the main, when you send a fax your machine will automatically start to transmit the message when the remote machine indicates that it is ready to receive. In other words, all the fax machine ascertains is whether there is a fax machine at the end of the line, not whether it is the fax machine of the person to whom you wish to send the document. Many Group 3 fax machines can operate an answerback system, similar to telex, when both units have a compatible facility. In the case of telex, for example, you have to give the correct answerback code before the machine will transmit and this is a safeguard against misdialling.

Another security problem is that the message is immediately printed out at the receiving end. Anybody passing the fax machine will be able to see and read the document being received. This problem can be overcome by using the secure mailbox facility available on some fax machines (see page 13).

If you are likely to want to send documents of a sensitive or commercially confidential nature you need to consider carefully what type of fax machine to use and whether fax is the best method. At the very minimum you will want a machine which gives a visual display of the number dialled so that you can, if necessary, cancel the call before your machine starts to transmit the message. It is also sensible to contact the person at the other end first by telephone to advise them of your imminent fax. If you are likely to want to transmit or receive highly sensitive material on a regular basis then you and those with

whom you are in contact might need to consider using fax machines which are capable of encrypting transmitted material. In any case, it is always worth double-checking the number you have dialled in, particularly if you are reading the number off a list.

Junk faxes

There is increasing concern about unsolicited sales approaches by telephone, fax and telex (although the latter is very rare). Unwanted approaches by fax can be particularly annoying because the sales information is printed out on the recipient's own fax paper. Under the class licences mentioned earlier (see page 3 and Glossary) you can take steps to stop persistent callers. OFTEL has published an information sheet on the subject which is available, free of charge (see Bibliography for more details).

4 ELECTRONIC MAIL (email)

Electronic mail - or email - is the general title given to a collection of different services which enable users of personal or office computers to send and receive messages, or to have information stored for them on a central computer maintained by the service provider. Access can be obtained through a dedicated terminal, a computer terminal or by fitting a modem to a personal computer, small portable computer or electronic typewriter which enables the user to send and receive text over public telecommunication networks. The apparatus which you use to interface with the public networks must be approved for this purpose.

Some fax machines have a 'mailbox' facility which allows your fax machine to receive and store messages rather than immediately print them out. You can then access the messages by inputting a special code. Similarly your fax machine can transmit a message into the mailbox of the receiving fax machine. This system can only work when the transmitting and receiving fax machines are compatible - usually the same make or model - but it does make the system more secure. Some computer programs allow you to use your computer as a mailbox via a modem. This offers a store and send system directly between computers. Neither of these two types of mailbox system require a separate company to manage the service and are not discussed further in this section.

There are currently about 20 different email services operating in the UK of which the three most widely used are believed to be BT's Telecom Gold (now upgraded and known as BT Mailbox), Sprintmail (operated by Sprint International) and Mercury MultiMessage (for indirectly-connected customers). All these comply with the X.400 standard (see page 16 and Glossary). Mercury offers additional email services for directly-connected customers. Although the services currently licensed to operate in the UK differ slightly in the facilities they offer, they all basically work like this:

1 You pay a basic registration fee to the email service provider. These vary but are generally lower than for renting a telephone line. You are then allocated a 'mailbox identity code' (a sort of electronic pigeon hole number) on which a monthly rental or minimum invoice is charged. You also receive a private password.

2 To send or receive messages to or from other users of the service, you need to have a terminal (see above).

3 All messages are sent and received via a central computer system run by the service provider. To send a message to another 'mailbox' you connect to the central computer by dialling a special telephone number, then transmit your message using the other mailbox's code. The message is stored and can only be seen by the recipient after he has 'unlocked' his mailbox by connecting to the computer and giving his private password.

4 The same procedure applies in reverse if somebody sends you a message. Each time you dial into the computer you receive a brief message informing you whether there is any new mail for you. You can only retrieve these messages when you have entered in your own private password.

Unlike telex, email services do not restrict you to using capital letters and rudimentary punctuation - you can use all the characters found on a normal typewriter/word processor keyboard and even some which are not. With most services it is possible to send pictures or diagrams by binary file transfer.

The main advantage of email over the other systems, however, lies in the fact that you can send or receive messages wherever you happen to be by using the telephone network. Telex or fax messages can only be received at the

address where the telex or fax machine identified by the telex or fax number is located. As electronic mailboxes are held centrally on the service provider's computer, they can be accessed from any telephone on the public or international telephone network using suitably approved equipment. To retrieve your messages in this way you need to link your portable computer via a modem to the telephone line either by means of an acoustic coupler or a plug-in telephone connection. The illustration below shows a typical link of this kind.
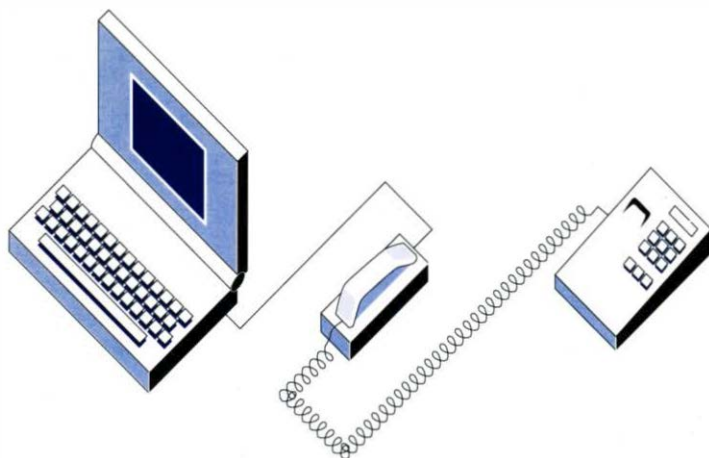
One disadvantage of email is that your messages are not printed automatically when they are sent - you have to remember to dial up your email service and check if there is anything stored in your mailbox. There may also be a storage charge incurred for messages that are not cleared within a certain time.

Deaf or dumb employees

If you or any of your employees suffer from severely impaired hearing or speech defects, email systems can offer a practical solution to many difficulties in communicating over telephone lines. Direct computer-to-computer links and mailbox facilities on fax machines could also prove useful (see pages 13 and 18). Contact the appropriate disability organisation or institute, eg the Breakthrough Trust, RNID, etc, for more information on especially appropriate or special services.

OFTEL's Working Group for the Hearing Impaired (WGHI) has produced a guide to the requirements for text communications equipment. Although this

was prepared with the needs of hearing impaired people in mind, the Guide offers useful operational and technical information to all potential users of text communication terminals (see Bibliography, page 3●).

The data network

If your company sends or receives large amounts of data, it could be economical to subscribe to a fixed or mobile public data network (see page 21). To gain access on the fixed data networks, you need a network user identity. If you intend accessing your email box via the fixed public data networks from telephones other than your own, you would need to make this clear when you apply for a network user identity code.

Links with other email services

In the past the most significant drawback with email services was that there was little compatibility between the various email services on offer. This meant that if you subscribed to one service you could not communicate with a customer of another email service. In the UK all major public email providers are connected via X.4●●, an internationally agreed set of recommendations which provide for the interconnection of different types of data communication services (see Glossary), so this problem should now be overcome.
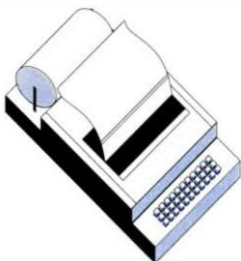
5 TELEX

For over fifty years telex was the main form of text communication - until the advent of fax. It does still has some advantages over fax. The main one is that telexes have considerably more legal standing because of the security of the system. The answerback requirement means that both the sender and receiver are identified. Apart from the answerback system, because telex uses what can be considered as a separate network with a different form of number, the scope for contacting a wrong number is considerably reduced. Another advantage of telex is that the end of the message is clearly marked.

Several parts of the world (Africa and the Indian sub-continent in particular) still rely almost totally on telex and do not yet have a large installed base of fax machines. If you trade with those parts of the world where fax is not available or is unreliable because of poor line quality, then you might consider telex. Telex also remains one of the most economical ways of sending brief,

urgent messages. BT does offer discounts for very high usage customers - check with BT for details.

The limitations of telex, when compared with fax and email, lie in its restricted vocabulary - only capital letters and limited punctuation. Only text can be transmitted, not diagrams or photographs. As a special line is required for telex, the system is considerably less portable than either fax or email.

Modern telex machines are no longer the loud, chattering devices of yesteryear which had to be placed in a separate room so that employees were not distracted. Today telex machines resemble office computers and usually have their own word processing facilities so that messages can be easily composed and edited before transmission. They may also have memory facilities which enable you to store your own business directory of most used numbers. The machine can then be programmed to dial the required number automatically if you key in the company name or a group of companies.

Another useful feature is that some machines will, within certain limits, keep trying an engaged telex number until they can get an answer, or will alert you if they have been unable to transmit the message after a certain length of time.

There are comparatively few models of dedicated telex machines on the market and prices at the time of publication varied from about £1500 for a basic machine up to just over £3000 for a machine with sophisticated computer-based facilities.

However, it is not necessary to acquire a dedicated telex machine. There are various economical devices available which you can add onto your office or personal computer so it can be used as a telex machine. These devices may allow you to send and receive telexes without preventing the computer from carrying out other functions at the same time. These devices are known as 'telex boxes' and act in a similar way to a modem.

The add-on device or dedicated telex machine you choose for your business must have been approved by BABT for connection to the telex networks operated by the public network operators.

You will need to rent a separate telex line in addition to your telephone line. A normal telephone line cannot be used for transmitting or receiving telexes. The rental charge is slightly higher for a telex line than for a normal telephone line. In addition you will be charged for call 'units' for telexes transmitted, *not* those received. The cost of telex calls is roughly equivalent to cheap rate calls up to 56 km and peak rate calls over 56 km. As an approximate guide, a telex machine will transmit about 66 words a minute.

Both Mercury and BT operate telex networks. Access to the Mercury telex network can be direct (7100 service or the enhanced 7125 service) or indirect (7200 service).

Telex bureaux

If your business has only a limited demand for telex, you might find it worthwhile using a telex bureau instead of acquiring your own equipment. To use the service you telephone the bureau, dictate the message you wish to send and the bureau then transmits the message on its own machine. Incoming messages are given to you over the phone with paper copies sent through the post.

The advantage with telex bureaux is that they can be very cost effective if you send and receive few telex messages. The disadvantage is that they can be less convenient as you do not have direct access. However some offer extra facilities like 'store and forward', multi-address and access to fax and email services. Costs usually include a basic registration fee and/or a regular payment (monthly or quarterly) to the bureau plus normal telephone and telex charges for each message you send. For further information, consult your local Yellow Pages or Thomson directories.

6 COMPUTER-TO-COMPUTER

A very quick and convenient way to send data over the telephone network is to use a direct computer-to-computer link. To use the public telephone networks this way both the sending and receiving computers must be attached to a telephone line via a modem approved for the purpose. The modem converts the information from a pure data form (digital) to modulated audio-frequency tones - a form resembling speech signals - which are much less susceptible to noise interference (see also Glossary). The modem at the

far end converts the tones back to data. If you are using a digital or ISDN data transmission line (see page 21) you do not need this conversion (ie no modem) but you will need an interface box or card. In this case the data is carried in its digital form.

The modem might be a separate unit or could come as a built-in option on your personal computer. A choice of speed of transmission is available but the receiving modem must be capable of accepting a transmission at the rate of your modem and the error correction and data format protocols must be compatible. An approved modem costs from about £200 upwards depending on speed and mode of operation. You also need a software communications package in order to send blocks of text. Telephone numbers can also be stored ready for use. You may find that your existing software includes such a package. Most text is sent in an agreed data code called ASCII (see Glossary). This allows the individual characters to be recognised by the receiving computer. Most software will convert files into ASCII for transmitting. The file, once received, can then be imported into the software you wish to use for editing. The information is transmitted very quickly so call costs are low.
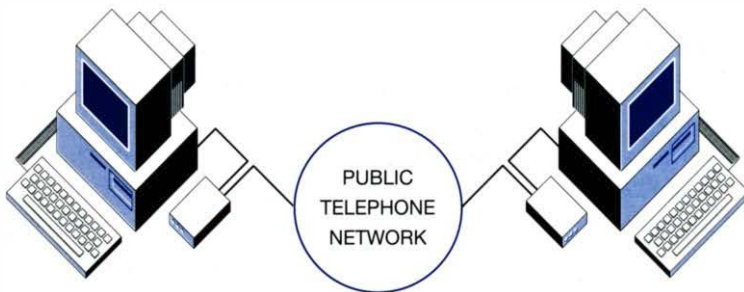
Diagrams can be sent in bit-mapped or vectored form but you should check that the software at the receiving end is compatible with yours and can accept the transmission. You should note that the length of the call - and so the cost - rises markedly with the increasing complexity of the diagram.

As with the fax modem, direct computer links save staff time and paper costs. This can be an attractive option if you need to send information to destinations known to have a computer linked to a modem or if you have homeworkers or staff in remote offices in your business. Computers can be set up to 'talk' directly to avoid misunderstanding during a spoken

conversation. This is much slower than transmitting blocks of information because you are limited by the speed of typing and so call costs are relatively high. However it is a very useful option for hearing-impaired people.

7 INTERSYSTEM COMPATIBILITY

Mention is made elsewhere of the technical constraints which currently prevent users of one type of text communication system from being able to contact 'electronically' users of other systems. There are many technical criteria (such as those to be met when trying to implement electronic text (ASCII) or data communication between two users over the public networks). However these should not deter the potential user. Manufacturers and suppliers can normally give excellent advice and help on installation and configuration of their systems. A communications system may even have the ability to configure itself automatically to match another system to which it has been connected.

There are, at present, some links between the various services. Most email services offer links (or 'interface') to public telex networks and fax networks for onward transmission. This means that, even if your business does not use telex, you can still send and receive telex messages via your electronic mailbox. The cost is higher than for normal telexes but if you only need to send a few a month this hybrid facility might be worth considering. The system applies in reverse as well - if you only subscribe to telex, you can still send messages to somebody who is only an email user, providing you know they have a DDI (direct dial in) telex number linked to their mailbox identity. Services such as Mercury's MultiMessage service offer a combination of email, fax and telex via your computer terminal in a single service.

8 MOBILE NETWORKS

You can use the mobile cellular networks operated by Cellnet and Vodafone to send data by fax, email or computer-to-computer. This can be a very convenient way of sending data when you are on the move. However, bear in mind that these are radio-based networks and so, especially in areas of marginal coverage, you might occasionally experience some difficulty in transmitting data. Also call charges are higher on mobile networks than on fixed networks so the cost of sending your data will be more.
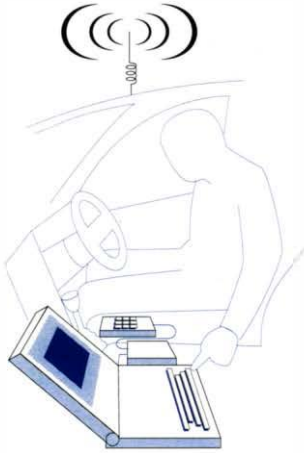
To connect a small portable computer or fax machine to the mobile networks you need both a modem and a data interface attachment. Some portable computers have an integral modem and a few recent models include both a modem and data interface internally. One option recently developed comprises a computer with its own radio unit and aerial which can access the mobile networks directly.

If you send a great deal of data from a mobile terminal, you might consider subscribing to the mobile data networks (see next section).

9 DATA NETWORKS

If you receive and transmit a great deal of data, you might consider subscribing to a public data network (for example, BT's Global Network Services - GNS - a managed data operating service). There are both fixed and mobile data networks available.

Fixed data network

The GNS fixed data network is based on packet switching. The basic technology used is X.25, the standard for packet switching (see Glossary). The data you send is assembled into electronic 'packets' at the GNS exchange. The packets are of fixed size but composed of data from one or more sources. The packets are then transmitted over the network in the most economical way. The data you send might be put into more than one packet and the packets sent by different routes. However all the pieces of data are coded so that at the distant end the packets can be separated out, sorted into the correct order and the complete data delivered to your recipient. Because of the cost-effective method of onward transmission, 'call' charges are cheap and independent of distance. They depend on the amount of information sent, ie the duration of the 'call'. You cannot revert to speech on GNS as you sometimes can when using the normal telephone network for data transmission.

You can gain access to the GNS either by:

- a normal telephone line. You need a network user identity for which there is an initial charge and a small quarterly rental. For every data transmission via the GNS you will be charged for the telephone call plus the GNS charges. The two charges together would normally be less than the cost of a long distance telephone call.

- a private dedicated connection. You rent a data line to the GNS exchange for your private use. You avoid the telephone call charges and the packet switching charges are cheaper but the private data line rental is fairly high. This would only be an economical solution if your usage was high.

The advantages of using a data line are that the message is transmitted in digital form and is not converted into an analogue signal (see page 18). This means that both call set-up and transmission are very fast. Over data lines there is less risk of error through interference. The very fast Group 4 fax machines can be used over the data network.

Mobile data networks

A number of companies offer a mobile data service. This might be worth considering if you regularly need information from a computer system at your main office when you are out and about. For example, sales staff in the field
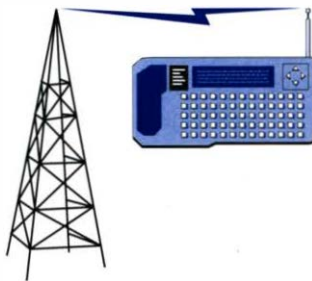
might want details of prices, stock levels, credit worthiness, etc, when with or near a customer or engineers might need technical details when visiting a site. The most efficient way to obtain the information might be to interrogate the office database direct using a mobile terminal. As with fixed data networks

there are accuracy and speed advantages when you use fax and email over the mobile data networks as opposed to the normal mobile networks. Other mobile services, such as radiopaging, may be offered with the data services.

Another alternative is to subscribe to a trunked Band III PMR (private mobile radio) service. These provide contact between your office and a fleet of mobile units (for example, trucks or cars) and offer direct data transmission services. These are not public networks - access is for subscribers only - so you are usually limited to contacting your staff on the road but the service can be very cost effective. There is one national network - operated by National Band Three Radio Ltd - and a number of regional networks.

ISDN

Another form of public fixed network now being offered is the ISDN (integrated services digital network). ISDN is designed to handle voice, data, text and image at high speed in digital format. Again the advantages are speed of call set-up and transmission, and very low error in transmission. ISDN lines can be used simultaneously for different services. With the combination of services possible, options such as videoconferencing, Group 4 fax, slow-scan TV and video surveillance are offered. Most ISDN services offer high capacity circuits and require very high usage to be economical. However BT's ISDN 2 service is designed for small businesses. The network can be accessed via a special telephone line similar to your normal telephone line. You pay a line rental and then call charges on a usage basis. Call charges are the same as for the public telephone network. However, international data calls can be significantly more expensive than voice only calls to the same destination. Equipment which is not designed specifically for an ISDN network requires an interface terminal adaptor.

Another term you might encounter in digital data transmission is **multiplexing.** In effect this allows more than one stream of data to be transmitted over a single circuit (for example on the ISDN line) simultaneously so that several computer terminals can share each communication line without delay. There are a variety of multiplexers available for use on different types of network.

10 CONCLUSIONS: HOW TO CHOOSE THE BEST SOLUTION

As we hope this booklet makes clear, there is no one ready-made solution to the needs of a small business requiring a quick way of exchanging data. The table which follows attempts to offer a brief summary of the comparative strengths and weaknesses of each option, including the basic voice telephony service.

The following questions are intended as a brief guide to the sort of factors which you should consider when deciding whether or not to commit your business.

1 Is speed and accuracy of communication vital to my business in order to avoid the risk of losing business if people cannot get the information easily, quickly and without the risk of misunderstanding?

2 Will the system I choose improve my profitability?

3 If your answers to these two questions are 'yes' you should find out which systems and what equipment are used by your major clients, suppliers and distributors. There may be a particular system in widespread use in your trade or profession. Does your trade or professional association offer any special communications guidance?

Once you have established which system offers the best prospects for your business, shop around for the best deal. There are plenty of journals to consult or exhibitions and local showrooms of business and telecommunications equipment which you can visit.

Competition in the telecommunications market - especially for equipment - is now fierce, so it is often possible to drive a hard bargain. Always keep your basic needs firmly in mind and do not be distracted by additional (and often costly) features. But remember also that you will want a reliable system and the cheapest may not match your requirements in this area. Make sure that the equipment you purchase or lease is approved and that the after-sales or back-up service is good.

Feature	Telephone	Telex	Fax	Email	Computer/ modem
1 Can I make use of my telephone lines?	YES[1]	NO	YES[1]	YES[1]	YES[1]
2 Can I transmit drawings, graphics, etc?	NO	NO	YES	YES	YES
3 Will there be a hard copy of my message?	NO	YES	YES[2]	YES[3]	YES[3]
4 Can I or will I be able to communicate with users of all other types of services and equipment?	N/A	SOME	LIMITED	YES[4]	YES[4]
5 Can out going and incoming messages be stored when offices are unattended?	LIMITED[5]	YES	YES[6]	YES[7]	YES
6 Can I obtain access from any telephone?	YES	NO	YES	YES[8]	YES[9]
7 How many users: **a** in the UK **b** worldwide	25m 800m	111k 2m	1m 20m	170k unknown	unknown unknown
8 How long does it take to transmit an A4 sheet containing 1500 characters?	n/a	3.45mins	3 secs to 3 mins[10]	7-10 secs	varies[11]
9 Are call charges based on: **a** distance **b** duration **c** amount of data **d** time of day	YES YES NO YES	YES YES NO NO	YES YES NO YES	YES YES NO YES	YES YES NO YES
10 Do I automatically receive a confirmation of delivery?	NO	YES	YES[12]	NO	NO

Footnotes

1 Fax, email and direct computer-to-computer transmission are available on public data networks. Voice can be included on ISDN lines.

2 Print on some thermal paper has a tendency to fade after a while - always photocopy if you want to keep a record.

3 Provided you have a printer connected to your computer/terminal and print out a copy.

4 You may need additional hardware and/or software (eg fax modem)-see also **Intersystem compatibility** page 20.

5 Answering machines for recording messages are really only practical for comparatively short oral communications.

6 It is preferable to have a dedicated fax line for this purpose.

7 You contact the bureau computer to see whether there are any messages waiting for you.

8 You will need a small portable computer with a modem and an acoustic coupler.

9 You will need a modem for PSTN lines.

10 Transmission speed is dependent on the capability of the receiving machine. Only Group 4 machines which operate exclusively on data networks, including ISDN, can transmit as fast as 3 secs. The average speed is two to three pages a minute for a Group 3 fax.

11 Depends on speed of modem on PSTN lines and type of network (very fast over end-to-end digital networks) but similar to email.

12 Some machines may not issue a confirmation of delivery.

11 FURTHER ADVICE

This booklet does not aim to give specific advice on any individual company's services or equipment. If you would like more detailed reading matter before proceeding any further, OFTEL's Library can provide you with a regularly updated list of published sources of information on systems and suppliers (a short bibliography is given in Section 12).

You may also seek advice from system suppliers themselves or, if you feel that you would like an independent appraisal of your business needs carried out, you could engage a telecommunications consultant. Your local Chamber of Commerce, Chamber of Trade, or Small Firms Advice Centre may be able to put you in touch with appropriate consultants. Alternatively consult your Thomson or Yellow Pages directories.

BACT

This booklet has been prepared for the independent Advisory Committee on Telecommunications for Small Businesses (known as BACT). BACT members are business people drawn from a wide range of commercial and industrial

backgrounds from all over the UK. The Committee was set up to advise the Director General of Telecommunications on telecommunications matters affecting small businesses. Any general enquiries or comments about this booklet should be made to the Committee through BACT's Secretariat which can be contacted at the following address:

Room 2/3
50 Ludgate Hill
London EC4M 7JJ

Tel: 071-634 8770/2
Fax: 071-634 8943

12 BIBLIOGRAPHY

The following is only a brief selection of recent reading matter available at the time this booklet was published. It offers some independent appraisals of equipment and services that are available for telex, electronic mail, fax and modems.

Note: These listings do **not** constitute any endorsement of the views or recommendations contained in these publications.

Telex machines

A buoyant telecom market *Telecommunications* 1 June 1992, p4

Down but not quite out.Telex brand survey *What to Buy for Business* **No 130** January 1992, pp35-48

Telex answers back *Communications* **Vol 7 no 4** April 1990, pp43- 48

Telex still holding its own *Communicate* October 1989 pp52-55

The survival of telex: produce survey *Communications* **Vol 6 no 10** October 1989, pp33-42

WAN suppliers. Telex survey included *Computing* 18 June 1992, pp40-47

Electronic mail

Buyers guide: Email software *PC Week* 7 July 1992, p43

A mailbox muddle *Communications networks* **Vol 9 No 1** January 1992, pp43-48 (includes a list of X.400 products currently available)

Email: Fulfilling the final promise *Communications News* March 1992, pp32-35

Email makes royal progress *Communicate* June 1992, pp28-34

Embracing email *Communications* **Vol 8 No 10** October 1991, pp39-42

Fax

Dealing in the fax lane *Lines of Communication* **Vol 4 No 11** November 1990, pp21-27

Fax at your fingertips *What to Buy for Business* **No 122** May 1991, pp3-115

Fax facts *Office Buyword* February 1992, pp8-10

Fax special *What to Buy for Business* **No 134** May 1992 (comprehensive guide to buying and running fax machines - assessment of over 200 models)

Getting to the heart of the matter: fax cards *Communications* October 1991, pp64-65 (product survey)

How to buy a facsimile machine: buyer's guide *Office Equipment Index* November 1991, pp16-19

Making more of fax *Communication Products* February 1990 pp12-23

Still not towing the line *Communicate* August 1992 pp30-34 (includes points to consider when choosing a fax for integration into a computer system)

Fax modems - global communication *PC Magazine* February 1993, pp164-195

Plain paper fax machines *What to Buy for Business* **No 150** September 1993

Fax update report *What to Buy for Business* **No 144** March 1993

Modems

Choosing the right modem *Communication Products* **Vol 1 No 7** January 1990, pp11-22 (includes an A-**Z** of leading companies)

High speed modems *Communications* **Vol 7 No 4** April 1990, pp43-48

Modem survey *Network* April 1990, pp61-69

Pocket full of power *Communicate* March 1992, pp23-31 (includes pocket modem survey)

Speeding up modems: product survey *Communications* **Vol 7 No 12** December 1990, pp47-54

Will modems stand and deliver? *Communicate* August 1992, pp16-28 (includes a modem survey)

Trade directories

Below are listed some of the key business directories which provide reference tables of suppliers of telex, fax and email and data communications equipment.

Computing and communications 1993 edition. Published annually by Kemps Publishing

The datacomms book 1992 edition. Published annually by VNU Business Publications

The international tele-communications suppliers' directory 1991/92 edition. Published by Associated Publishing Group

BACT and OFTEL publications

Other booklets in this series published by OFTEL in association with BACT are:

Does Your Business Need a New Telephone System?
A Guide to Cellular Radio

BACT also publishes an occasional newsletter - *BusinessLine*. To be added to the mailing list, free of charge, or to obtain one of the other booklets, telephone 071-634 8754.

Guide to the Requirements for Text Communication Equipment for use by Hearing-Impaired People and Others OFTEL's Working Group for the Hearing Impaired (1987)

Stopping unsolicited sales calls OFTEL Information Sheet no 4

A regularly updated comprehensive list of published sources of information on UK telecommunications suppliers and apparatus is available, free of charge, from OFTEL's Library, 50 Ludgate Hill, London EC4M 7JJ.

13 GLOSSARY

This glossary is intended to give an understanding of the terms used and does not imply any precise definition.

Acoustic coupling

A device for fitting physically to a telephone handset without the need for electrical connections. It incorporates functions of a modem and the analogue signals pass between the acoustic coupler and the telephone as sound waves.

ASCII

The American Standard Code for Information Interchange. This is an 8-bit code (the eighth bit is a parity check) which is most commonly used for sending data characters. CCITT has adopted ASCII as International Alphabet no 5 (IA5). Telex uses a 5-bit code.

BABT

The British Approvals Board for Telecommunications. This is the independent body responsible for the approval of telecommunications equipment in the UK. All equipment attached to the public networks must be approved for the purpose by BABT.

CCITT

The International Telegraph and Telephone Consultative Committee (the initials stand for the French equivalent which uses similar words but in a different order). This is a committee of the ITU (International Telecommunication Union), itself a UN body. The CCITT, which has several sub-committees, advises on the standards that should be adopted internationally for telecommunications.

Cellular networks

There are two mobile radio-based networks run by Cellnet and Vodafone. Fax and email services can be used over these networks using the appropriate

equipment. As the networks are radio based there tends to be more interference and so data transmissions are more susceptible to errors and interruptions than on the fixed networks.

Electronic mail

Generally this refers to the transmission of messages by electronic means but it is often used to refer to a service which allows subscribers to send messages to each other via a central computer. The messages are stored in the service provider's central computer and subscribers must ring up the computer to access messages stored in their 'electronic mailbox'.

Facsimile (fax)

A method of transmitting the image of a document, drawing, etc, and reproducing it at a distant point. Either the PSTN, PDN, or leased circuits may be used as the transmission medium.

Fax modem

A device that can be connected between your computer and telephone line so that your computer can act as a fax machine. The fax modem might be an internal card or a separate unit. Some fax modems do not allow for incoming messages. Images are sent in bit-mapped form and an optical character reader program is required to convert an incoming message into 'computer readable' form so the message can be edited using a keyboard. The standard bit-mapped form can usually be printed out in hard copy.

ISDN (Integrated Services Digital Network)

This is a digital network for high-speed transmission of voice, data, text and image in a digital form.

Multiplexing

This allows more than one stream of data to be transported over a single circuit (ie a number of devices can share the same channel) apparently simultaneously. A multiplexer is required at each end of the transmission channel. Multiplexing can be either in the frequency domain (FDM) or the time domain (TDM).

Modem

A piece of equipment connected between the telephone line and your computer for changing the digital signals from your computer into analogue signals suitable for transmission over an analogue telephone circuit, and vice versa at the receiving end. The name derives from the fact that it **mo**dulates the send signal and **dem**odulates the receive signal.

Polled line operation

A method of working whereby, instead of machines working into a central point, the central machine may originate calls automatically at a predetermined time and receive any messages that the distant machines may be holding for it. For example, a head office might wish to poll its branches at a certain time each day.

Public data network (PDN)

A network for transmitting data at higher speeds than can be achieved over PSTNs. Mobile data networks are also available.

Public switched telephone network (PSTN)

The networks operated by BT, Mercury and Kingston Communications (in Hull) that support all existing approved telephones and telephony services, such as fax and data, allowing any telephone subscriber to communicate with any other telephone subscriber.

Telex

A service enabling subscribers to communicate directly with each other by means of printed messages. Basic telex normally enables each way messages at 50 baud (approximately 7 characters per second). The telex network is separate from the PSTN and PDN although access can be gained to the other networks (see text).

Telex box

A box of electronic wizardry - basically a special sort of modem - that can be connected between the telex line and your computer to enable it to act as a telex machine. Telex boxes can include a range of facilities which are reflected in the price.

X.25

X.25 is the name of the set of standards defining the 'rules' on which packet-switched systems work. These standards are based on CCITT recommendations.

X.400

X.400 is the CCITT set of standards for message handling systems. This makes it possible for dissimilar equipment including telex machines and computers, as well as different email services, to exchange messages.

14 LICENCES

Any telecommunication system must be run under a Telecommunications Act 1984 (*the Act*) licence or (rarely) be exempt under Section 6 of the Act. Exempted systems are essentially those for the operator's sole use and are not connected to other systems. Licences under the Act are issued by the Department of Trade and Industry (DTI) and monitored by OFTEL. They are either class or individual licences.

In addition, a radio-based system requires a Wireless Telegraphy Act licence and these are monitored by the Radiocommunications Agency.

Individual licences These are issued to the public operators or **PTOs** (BT, Mercury, Hull, Cellnet, Vodafone, etc) and exceptionally to organisations running private networks which for some reason do not meet all the conditions of any one of the class licences.

Class licences Operators of telecommunications systems are deemed to have fulfilled the requirements of the Act if they run their system in accordance with an appropriate class licence. These licensees do not normally have to pay

any fee or even to hold a copy of the licence. Examples of class licences are the *Telecommunication Services Licence* (TSL) and the *Self-Provision Licence* (SPL). Brief details of these are given below. Most operators of private networks - and virtually all residential and small business customers - can run their systems under a class licence.

SPL This licence allows the running of any kind of telecommunications system and allows licensees to run systems over any distance in the UK. However, under the SPL all calls must originate or terminate with the licensee (or with companies in the same group as the licensee) and there must not be any "financial benefit or advantage" received for the provision of telecommunication services (other than for the recovery of costs). Licensees do not need to register.

TSL Most types of data service are allowed under the TSL, including resale services (but **not** international simple data resale services - ISDRS) and, like the SPL, registration is not required. Most kinds of on-premises telecommunications systems and links between them (where all the premises are no more than 200 m from each other) can be run under this licence. There is provision in the TSL for ISDRS to be permitted between the UK and other countries under specifications made by the Secretary of State. Specifications have been made for the countries in the European Community.

Note: The SPL and TSL (price £4 each) can be purchased from OFTEL's Library at the address shown below (tel: 071-634 8764/5). An explanatory guide, to be read in conjunction with the licences, is also available from the Library, free of charge.

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