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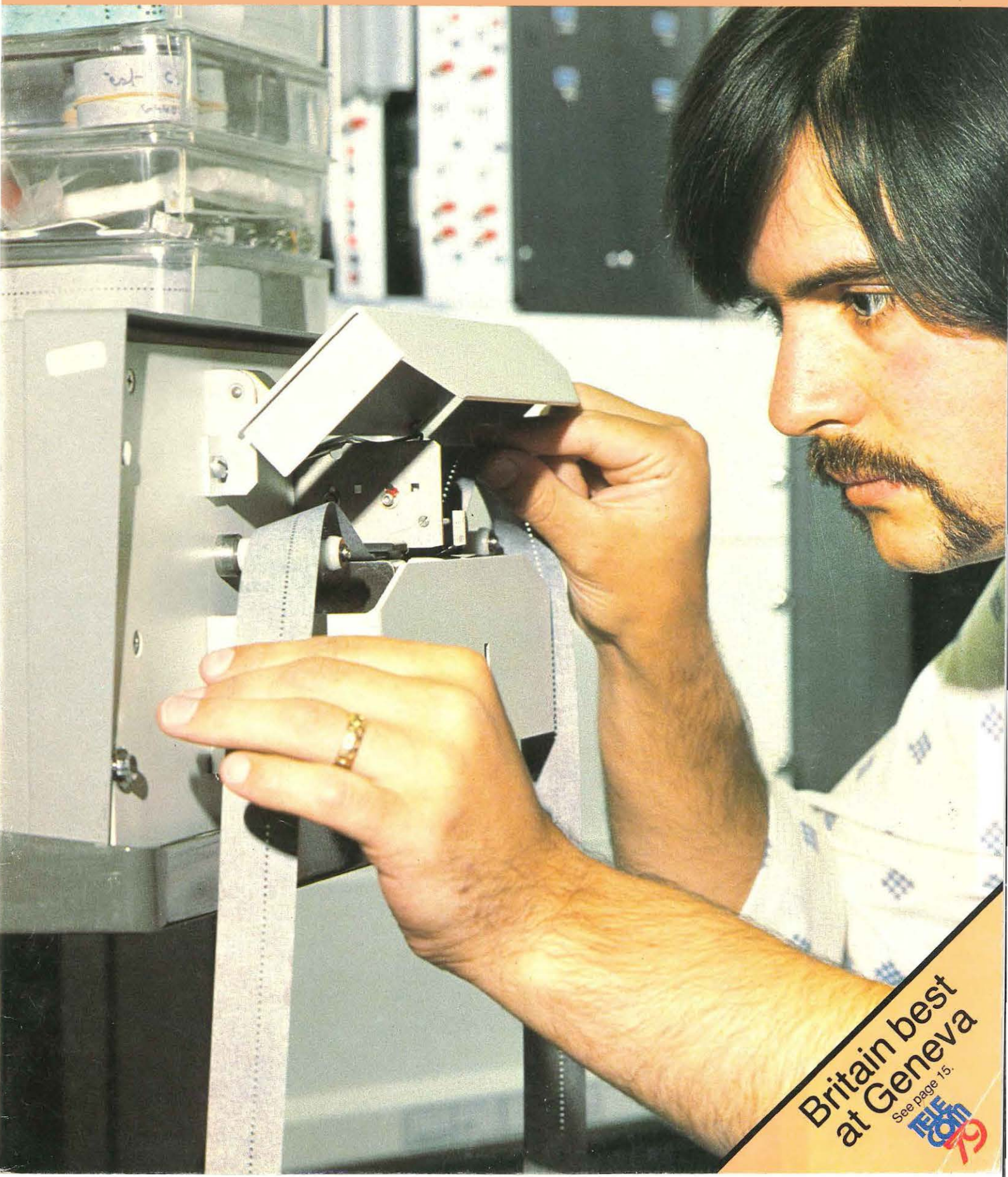

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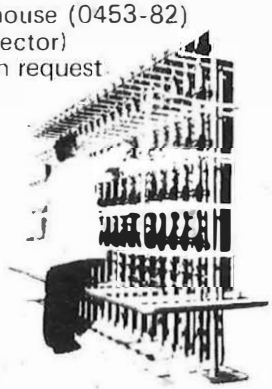

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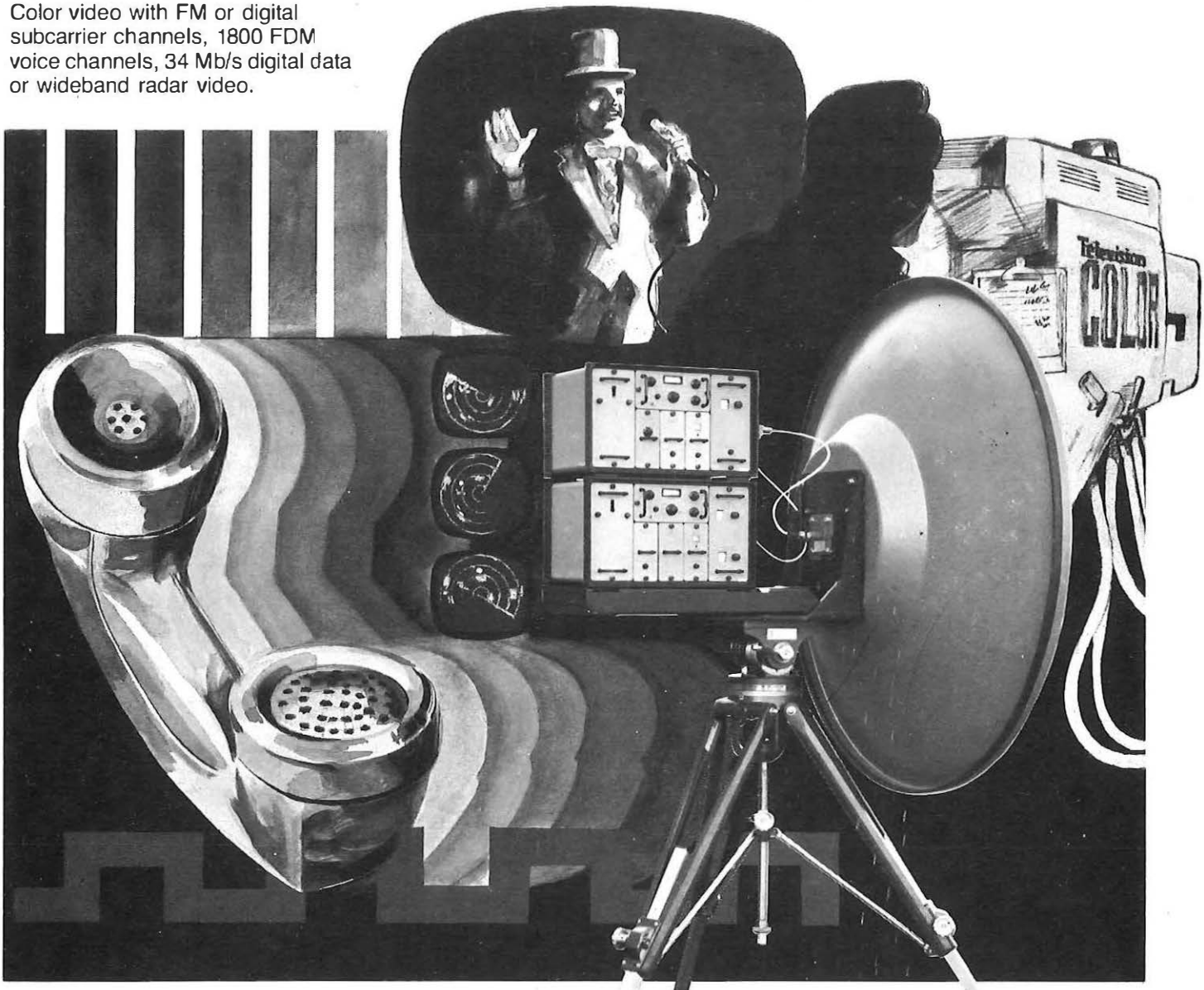

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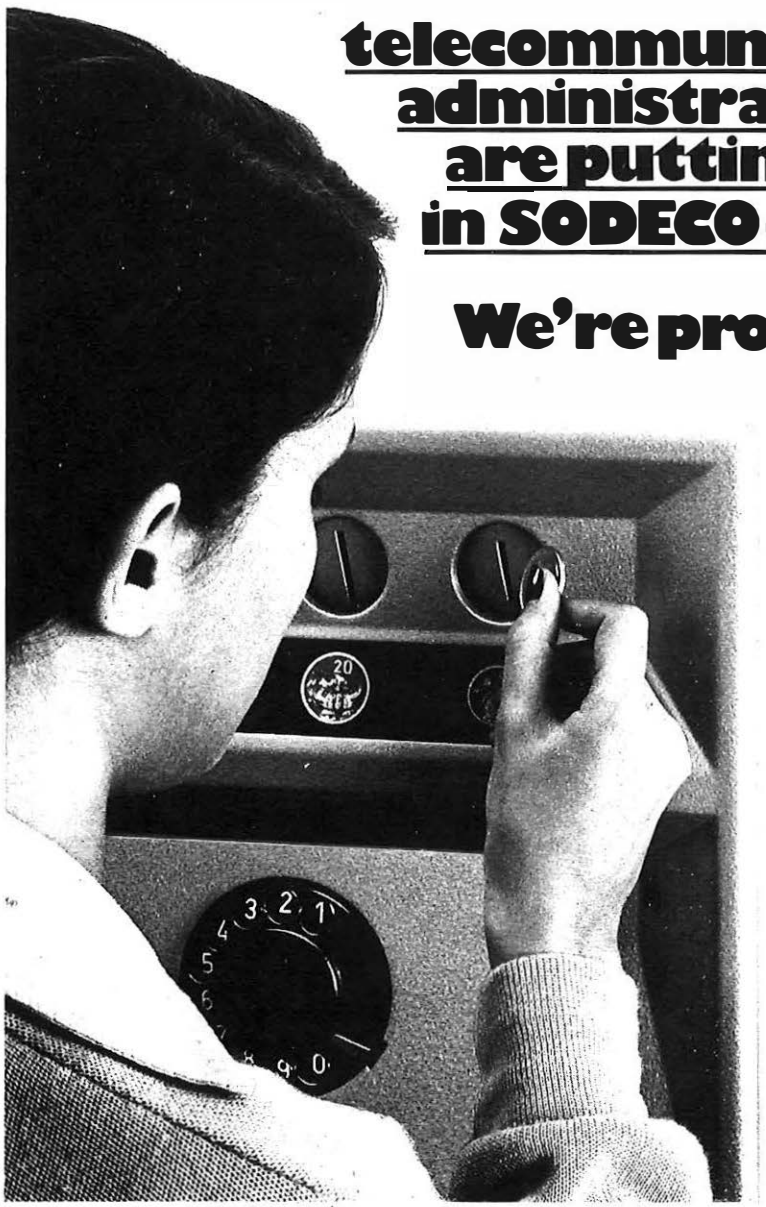

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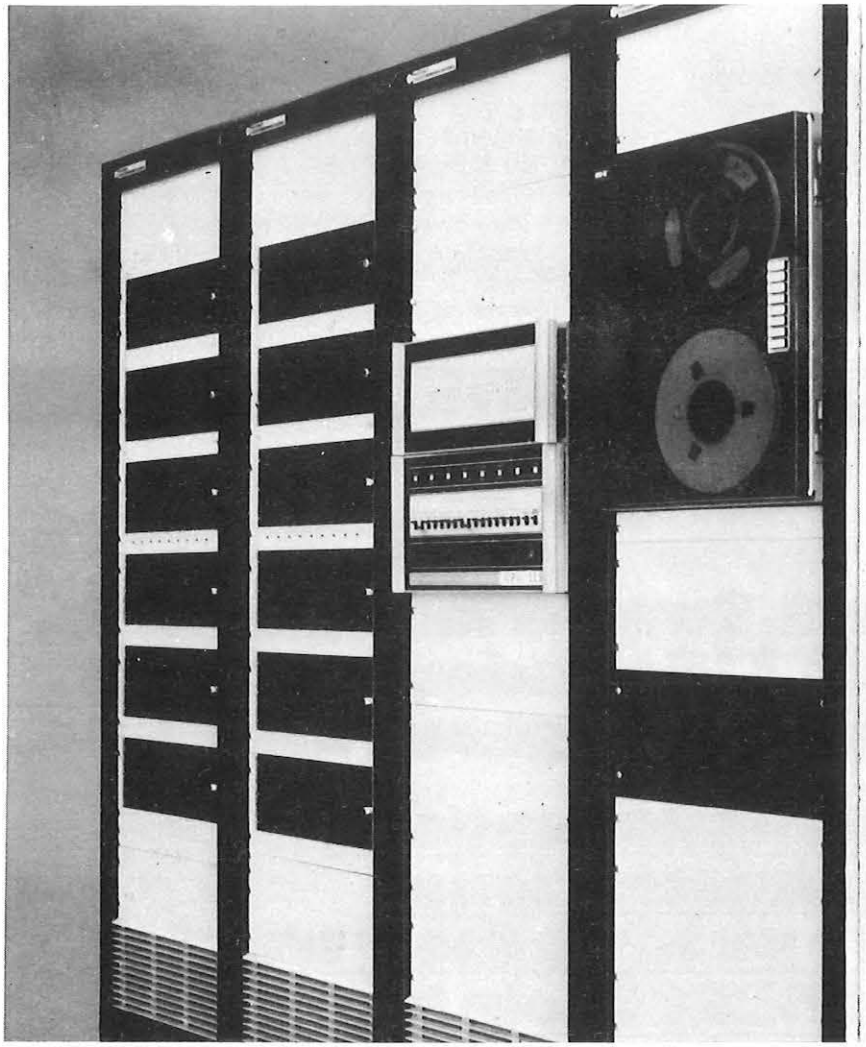

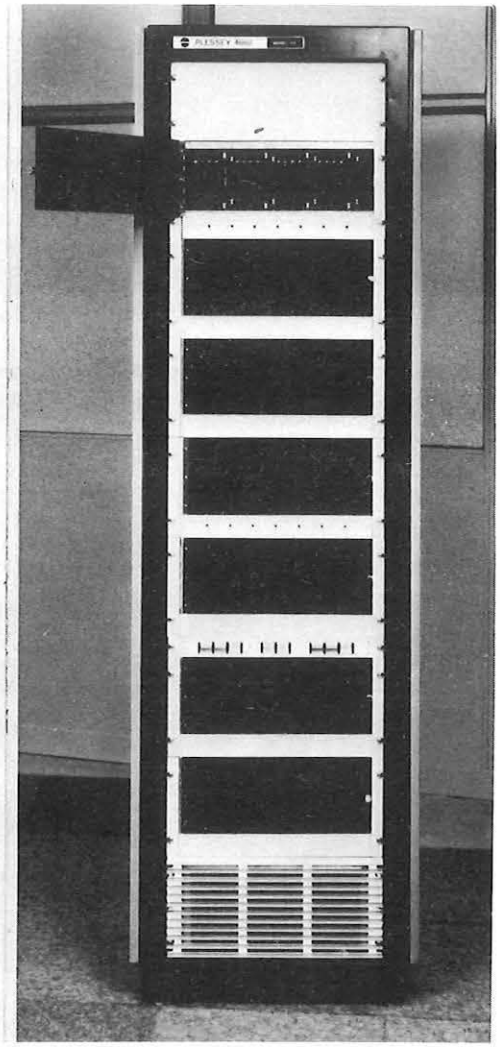

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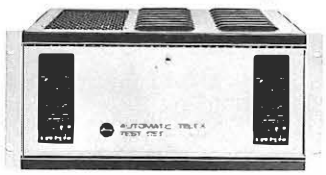

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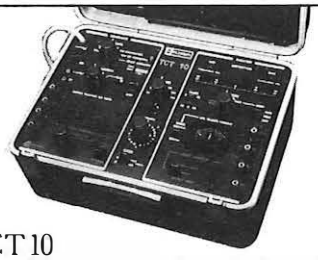

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Going separate ways

The Government's decision to reorganise the Post Office and to set up a new Telecommunications authority has the full support of Post Office Chairman, Sir William Barlow, who has announced his intentions of ensuring that the changes will be implemented as quickly as possible.

The recommendation to separate the Businesses was originally made more than two years ago in the Carter Committee report and Sir William points out that the reasons put forward in 1977 for creating two Corporations were even more valid today.

In particular he emphasised that both businesses were on a large enough scale to be comparable with other major nationalised industries and each threw up major problems deserving consideration at Board level. It was certainly now too much for a single Board to do justice to each organisation under the present structure.

There was also the fact that as each year passed the differences between the capital intensive, high productivity, highly technical, rapidly growing Telecommunications Business and the labour intensive, low productivity, less technical and slow growing Postal Business was accentuated. Each needed a Board dedicated solely to its own problems.

"For these and other reasons," said Sir William, "I believe that two separate Corporations, each with its own Board dealing with its own problems, will be more efficient."

On the question of the Telecommunications monopoly, Sir William said that the Post Office did not fear competition but it was important to keep in mind that changes would not necessarily bring about the improvements that many anticipated. The Board, in fact, remained to be convinced.

And as far as customers, suppliers and Post Office unions were concerned, Sir William said there would be consultations which he wanted to ensure would lead to decisions which were the best for the future of telecommunications in Britain.

First step for the Post Office would be to discuss in detail with the Secretary of State exactly what he had in mind, especially in the areas of licensing and safeguarding the network.

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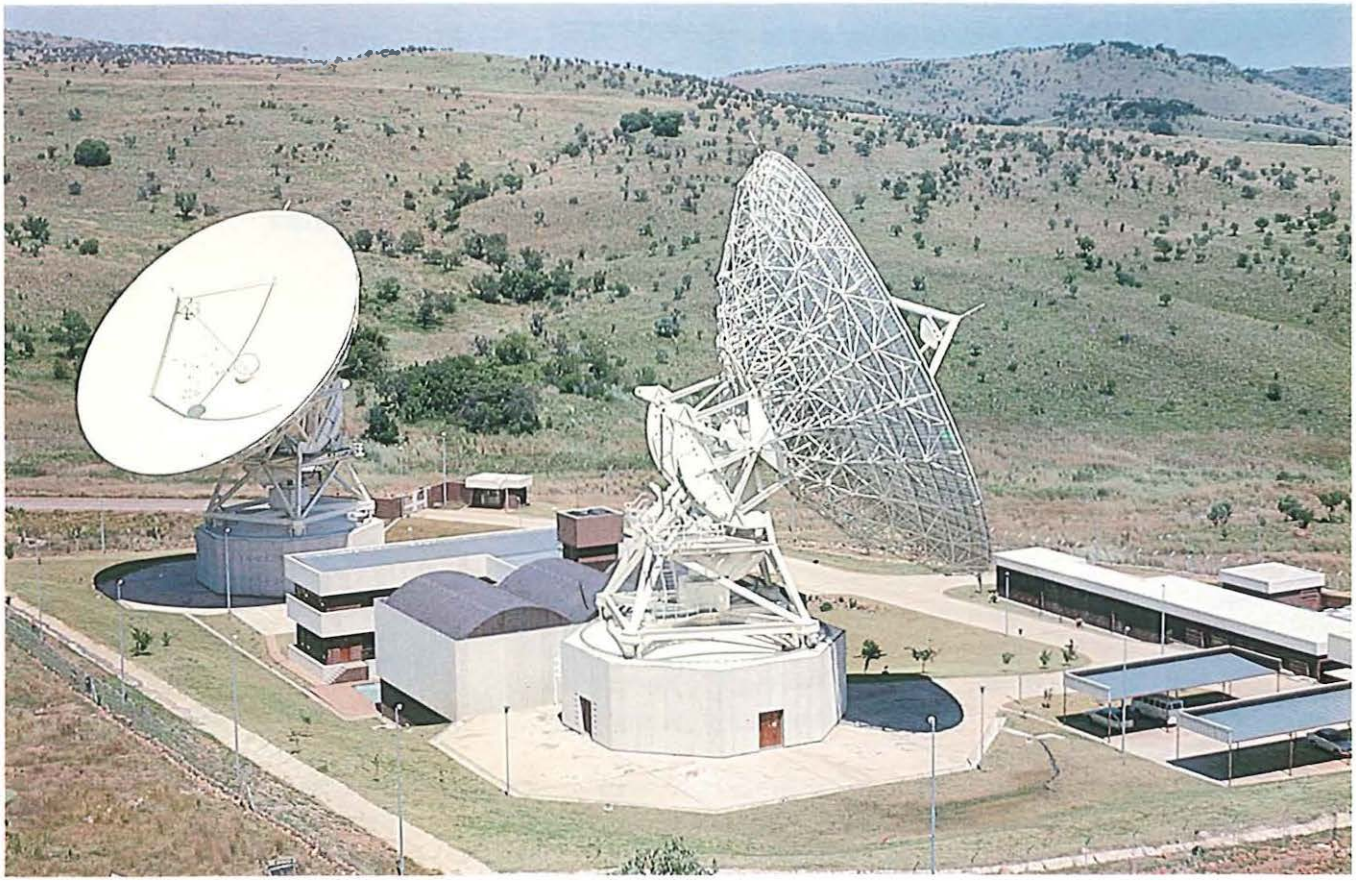
Cover: Technical Officer Brian Evans who works in the International Executive's Euronet centre loads a tape into diagnostic equipment at the London packet switching exchange. It searches the switching equipment for faults and controls the routing of data (see page 9).



The earth station at Hartebeesthoek near Pretoria which was used in the transfer of time pulse experiments.

Experimenting with time and space

D E White

The Post Office and the National Physical Laboratory (NPL) have recently co-operated in tests using communications satellites to transfer atomic clock time pulses from the UK to South Africa

MANY COUNTRIES in the world require not only precise measurement of the length of the second but also knowledge of their relative difference in phase from the so-called universal co-ordinated time (UTC). The UTC is maintained as a one second 'tick' at the International Bureau De L' Heure in Paris, and is a consensus of several atomic clocks from various standards laboratories in different countries.

To transfer this 'tick' from one country to another, a system of transportable atomic substandards is used, and this technique results in timing pulses in different countries being synchronised to about one microsecond. To keep this degree of precision it is necessary to make regular checks with these clocks and this is very expensive because the clocks are usually transported by air and occupy a passenger seat.

As well as being expensive this exercise is also somewhat unreliable because not only must the clock continue to run perfectly right up to the transfer instant, but it must also continue to run until its 'tick' can be recompared with the original standard. This is done to ensure that the drift rate of the clock has not changed since the start of the time transfer.

It may be thought that it should be possible to transmit such time pulses by telephone lines or radio, but for the precision required in this particular application, the distance must be known extremely accurately. This rules out the use of cables – even if the routing is known – and normal radio paths which change their length substantially as the ionosphere shifts.

The possibility of using satellite communications, however, was altogether more promising as 'line-of-sight' radio paths would show a minimum of unknown differential delay from one moment to the next. Almost as soon as

reliable satellite communications became available, therefore, experiments were set up to use them for synchronising time standards all over the world.

Until recently, however, it was necessary to use a great deal of the satellite's capacity to achieve anything like the required precision. Typically, satellite capacity for about 500 telephone circuits might be required, and even then, the accuracy achievable would only be about a microsecond.

Quite independently from this, the Post Office had been working on a system for accurately ranging communications satellites for the purpose of synchronising digital communications systems and it transpired that with some modification the equipment could be used to measure the signal path length to remote earth stations. The system was designed to use less capacity than would be required for three telephony channels and to be able to measure the path length to better than 10 metres. This is equivalent to being able to measure the time delay to about 33 thousand millionths part of a second (or 33 nanoseconds).

The equipment achieves this by transmitting a low frequency ($1\frac{1}{3}$ kHz) sine wave modulated carrier to the satellite and accurately measuring the phase difference of the returned signal. To achieve the required accuracy the phase difference of successive sine waves is measured for about a second and the average phase difference computed.

When used in the time pulse transfer mode, instead of the signal being received back at the originating ranging unit directly, it is first received by a similar unit at a remote earth station called the slave station. Here the signal can be accurately 'reflected' back to the satellite, and at the same time a pulse can be generated at the remote station which is simultaneous with the zero crossing of the 'reflected' signal.

This 'reflected' signal can then be received back at the master station. Because the approximate range of the satellite is known, the total number of sine wave periods on the round trip can be calculated: typically it is about 640 cycles.

When the Post Office received the request from the NPL to carry out further experiments in transferring time pulses via satellite to South Africa, it was decided to set up an experiment between Goonhilly earth station in Cornwall and Hartebeesthoek earth station near Pretoria.

The ranging equipment would operate via the Intelsat IVA Atlantic primary satellite using three narrowband channels in the SPADE single-channel-per-carrier transponder. This particular communications system was chosen because it incorporates accurate automatic frequency control, an important requirement where there are narrow channel bandwidths.

A few days before the experiments, a calibrated atomic clock was taken to Goonhilly and, as a cross check, its timing was compared with the BBC TV frame scan pulses which are synchronised throughout the UK. By measuring the difference in the frame rate in London (where the clock started) and Goonhilly, it was possible to check that no gross changes in the atomic clock had occurred during transportation. Another atomic clock and a synchronisation unit were then flown by non-stop jet to South Africa.

On arrival in South Africa, the South African Post Office and The South African National Physical Research Laboratories (NPRL) combined to help in the experiment. The first thing to be done was to compare the transported clock with the local clock to ensure that the time difference could be established as soon as possible. This meant that in the event of a complete failure of the transported clock, accurate time pulses would still be available to carry out the satellite experiment.

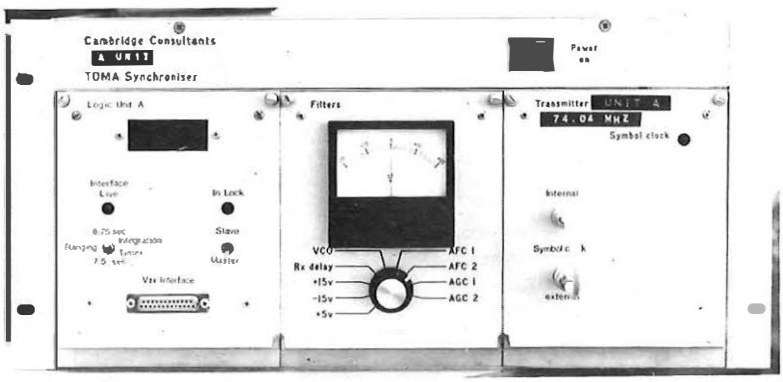
The equipment was then taken, mainly over dirt roads, to the earth station at Hartebeesthoek. The synchronisation unit was set up very quickly and, by the end of the second day, it was possible to attempt an initial test. During the next day, more precise measurements were made and, by the end of the experiment, correlation between the transportable clock and the satellite pulse was achieved to within 60 nanoseconds.

To gain this precision it was necessary to take into account the relativistic effect on the atomic clock due to its journey by air and the similar effect on the propagation delay in the satellite path. Finally, the equipment was returned to the UK and the travelling clocks recompared with the national standard at the NPL. This established that no unforeseen drift had occurred and that the time transfer had been completely successful.

Later the experimental ranging equipment was taken to the United States earth station at Andover, Maine, where the equipment was to be tested for its original purpose of synchronizing digital satellite links. While there, however, the opportunity was taken to carry out another time transfer between earth stations. On this occasion the transfer did not appear quite so accurate, an ambiguity of some 100 nanoseconds being apparent.

It is, however, thought that when the equipment is eventually returned to the UK it will be possible to establish that the error is actually within one of the ranging units, which, being prototype equipment, is subject to this sort of failure. If this proves to be the case the ambiguity can be allowed for and the experiment will be able to be considered highly successful.

Whatever the outcome, there is no doubt the principle has been proved and it is considered that if purpose-built equipment is used then regular synchronism between national standards of time will be feasible without the need to transport delicate atomic clocks by air, and with far greater accuracy than hitherto possible.



Left: The TDMA synchroniser at Goonhilly which was used in the time pulse transfer experiments.

Mr D. E. White is Head of Group in Space Communications Systems Divison of the International Executive with responsibility for the development of digital satellite communications systems.

New payphones take the credit

L L Grey

New style microprocessor-controlled payphones incorporating a sophisticated new range of facilities are soon to be installed on a trial basis mainly at high revenue public call office (PCO) sites throughout the UK.

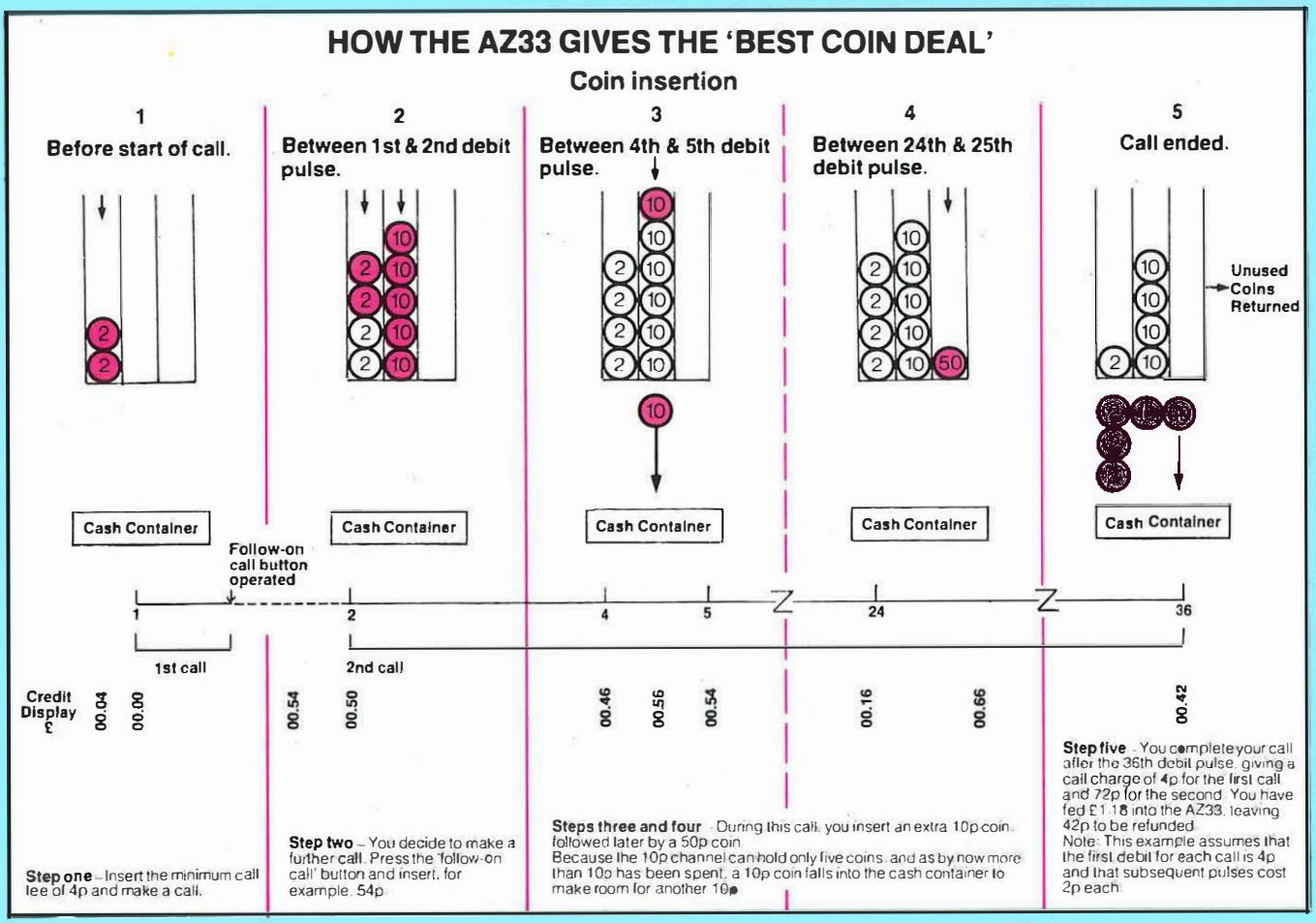
THERE CAN hardly be a single telephone user who would not like to see Pay On Answer (POA) telephones quickly phased out. Their fault record, their inability to make certain international calls, the need to stack up coins when making expensive calls and the interruption to speech when coins are inserted, are all features which have caused much irritation over the years. And as far as the Business itself is concerned, the tariff inflexibility, which necessitates a single coin minimum fee, is not popular.

Steps are being taken, therefore, to replace POA and the first move is to re-equip the 16,000 public call office (PCO) sites which take more than £1,000 a year. In all there are currently 77,600 PCOs.

During the autumn the Post Office began to take delivery of a trial quantity of 100 self-contained microprocessor-controlled coin telephones designated 'AZ33' by the Anglo/Swiss manufacturer, Agitelco, of Croydon. The model will be known as the Blue Payphone – it has blue directional signs and user instructions – to help the public recognise it and as a means of reference between customers and operators in operator assisted calls. The new coin telephones are being installed at Heathrow, Victoria Station, Trafalgar Square, Birmingham New St Station, Gatwick, Cardiff Airport, Glasgow Airport, Edinburgh, Manchester (Ringway), Dover Docks, St Paul's and Liverpool Street Station (with a further 10 on selected renters sites.)

The Blue Payphone is self-contained in that all the essential operating equipment, including the coin and fee check function, is contained within the coin telephone itself. It accepts 2p, 10p and 50p coins at the beginning of a call and can hold a total of about £3 if required until 'cashing-up' takes place at the end of a call (or series of calls). It has a four-digit light emitting diode (LED) credit display to show the value of credit remaining throughout the progress of automatic calls and a follow-on call button to enable the customer to make a series of calls for a single payment without replacing the handset. It also has full International Direct Dialling (IDD) capability. The AZ33 is connected to an ordinary exchange line via a subscribers private

Senior Technician Ray Guntripp, from LTR West Area sizes up an AZ33, soon to be fitted at Heathrow Airport's Terminal 2. Lending a hand in the foreground is colleague Brian Dare.



Making final checks before the new payphone leaves the workshop is Inspector Terry Parker.

metering (DPM) relay set in the local exchange and its tariffs therefore are basically linked to ordinary subscriber tariffs rather than coinbox tariffs.

Introduction of the equipment into service marks the culmination of three years of work undertaken initially by a small THQ team but, since the contract was placed in December last year, by a full THQ project team which has wrestled with the managerial, technical and personnel problems connected with the introduction of this sophisticated new equipment.

Unlike POA which employs direct coin collection by collecting money first and then putting paid time at the user's disposal, the Blue Payphone employs indirect collection by offering conversation time corresponding to the amount of money inserted. On completion of the calls, only those coins needed to meet the accrued charges are collected – starting with the highest value coin which has been spent.

Perhaps the most remarkable achievement in the UK version of the Swiss AZ coin telephone is the inclusion in the software program of the

full range of operator services available to ordinary subscribers lines. To the customer the making of operator-assisted calls is basically no different from POA. Non-chargeable calls are obtained by keying 142, 151 and so on in the normal way. In the case of chargeable calls, the operator, who will recognise the Blue Payphone due to the presence of a special identification tone, will ask the customer to insert money when the called subscriber answers. This money will pass straight into the cash box – unlike the procedure for automatic calls. Should the customer insert money immediately on lifting the handset and then key any three-digit operator code, the coins will be refunded after the last digit has been keyed.

It is possible to follow an automatic call by a chargeable (or non-chargeable) operator control call after using the follow-on call button. In such a case, coins inserted for the original automatic call are held in the coin store with the display showing credit remaining from the automatic call. Additional payment is made for the chargeable operator-assisted call as requested by the operator. When the customer finally replaces the handset the equipment will cash up for all automatic calls made, in the normal way. In other words, when the follow-on-button has been used, payment for automatic and chargeable operator connected calls are treated as separate cash transactions.

There is, of course, a price to be paid for such flexibility in meeting Business needs for both automatic and operator-assisted calls. In fact, between one quarter and one third of the microprocessor memory – total capacity 4k bytes – has had to be used for this purpose at the expense of self-diagnostic facilities which the AZ33 is capable of providing. In the field trial only, a second telephone pair is being specially provided to carry automatic diagnostic reports to the repair service centre. These reports will be limited to notifying a full cash container which would put the coin telephone out of action for paid calls or a coin checker/mains failure fault. The AZ33 is however designed to need not more than three maintenance visits a year – excluding vandalism.

There are a number of technical advances in the AZ33 design. Coin validation is a crucial feature of any coin telephone and in this case, coins are subjected both to physical and electronic checks. By virtue of its self-contained design segregated coin telephone lines are no longer required and this will permit greater flexibility in exchange planning and eventually enable POA coin and fee checking equipment to be removed once full production of self-contained pay-phones is under way. Tariff changes are effected simply by changing a coded plug in the control unit.

The coin telephone is mains powered. If there is a mains failure while the equipment is in use it will retain any money due until power is restored and return unused coins to the refund chute immediately. The 999 emergency service only will continue to be available during mains failure.

The cash compartment contains a 2.6 litre cash container with a self-locking mechanism which closes the coin aperture immediately the container is removed. Once this has been emptied in the coin counting centre, and before being replaced inside the coin telephone, it is necessary to re-set the self-locking mechanism inside the lid of the container. A coin meter, registering 1p units, is fixed to the cash compartment door and this is read each time the container is removed so that an accurate record of cash takings can be maintained. It is likely that these will be considerably in excess of POA equipment being replaced.

The field trial Blue Payphones will normally be recognisable by a blue sign over the kiosk bearing the words 'Intercontinental and Inland' to distinguish them from POA phones. When all the trial sites are operational more than 3,000 operators accepting calls from the trial sites will have been trained and 20 fitters and 30 maintenance staff will have undergone training at RETC Bletchley. About 12 presentations will also have been given to COPOU, and its constituent bodies, and to Regions and Areas taking part.

There will, of course, be the inevitable teething problems in launching the field trial. But once this has been completed, by mid-1980, the intention is to place a full production order and complete re-equipment of high-revenue PCOs within about five years. Simultaneously, a separate programme has been initiated for a medium/low revenue coin telephone which would be slightly less sophisticated than the high revenue variety and possibly quicker to produce.

At the same time, an in-depth study has examined the practical problems involved in providing public telephone service from equipment operated by pre-paid debit cards in lieu of coins to back-up – but not replace – coin-operated pay-phones. When the result of this study is to hand, together with a parallel study of technical possibilities, the Post Office will be in a position to decide when to begin and get some practical experience in the use of card phones as the third prong in the attack on the re-equipment of public call offices.

Mr L. L. Grey is a Head of Section in the Residential and Customer Service Department and is Project Manager for the AZ33.

PO Telecommunications Journal, Autumn 1979

A feature of the 2.6 litre cash container is the self locking mechanism which closes the coin aperture at the top of the container immediately it is removed.

Graduates make the grade

After reading law at Oxford and working for a local authority, **Mr Peter Wynne Davies** joined the Post Office earlier this year as a Telecommunications Traffic Superintendent in London Telecommunications Region. Here he describes his introduction to the Business at the national Telecommunications Management College.

Mr Tony Johnson, a tutor at TMC demonstrates the switch workings of a Strowger exchange to TTSs Bob Neate and Christine Hawkins. Both now work in THQ Network Executive.

IF ASKED TO suggest a common link between a lawyer, an ex-RAF pilot, a teacher, a biochemist and a Spanish graduate, most people would be hard pressed to give a logical answer. Not so, however, the tutors at the Post Office's Telecommunications Management College (TMC) in North London, for these professions were among those represented in the latest graduation of direct entry Telecommunications Traffic Superintendents (TTS).

Every year, about 30 young people are recruited to this grade, and with the raising of the basic academic requirement to graduate level, the backgrounds and interests of the recruits are now necessarily diverse.

The first contact applicants have with the Post Office is at the Appointments Centre at Euston Tower in London. After a series of stringent tests and exercises, successful graduates are appointed to a specific grade according to their aptitude and qualifications. Not surprisingly, very few potential Post Office managers have detailed knowledge of the Business structure, and a TMC tutor's first task is to explain to any TTS that 'traffic' has no connection with the motor transport fleet!

TTSs have to master knowledge covering the whole sphere of telecommunications and must be fully aware of new ideas and developments such as Prestel. On planning duties, they often have the unenviable task of attempting to predict a future through the mists of the many unknown factors that can affect demand for the telecommunications services.

After a while, TTSs may also find themselves dealing with customers' complaints – a duty needing patience, tact and dedication. Alternatively, they may be responsible for several hundred operators.

The TTS grade is in fact, a melange of varying jobs that range from planning to daily administration, from public relations to management. This total diversification of complex activities is not so readily to be found elsewhere in the Post Office, and this range of functions is represented in the TTS basic course – an 11-week marathon that covers everything from how a telephone works to the fundamentals of microwaves and fibre optics.

Some years ago, basic traffic training lasted six months, but with the explosion in new technology and research, a similar course today would be long indeed. Now only the general outlines of the system are included but even so,

tutors at the TMC still have to spend over three weeks explaining the basics of Strowger, Crossbar and electronic exchanges.

As the world of telecommunications grows, so too, do the basic requirements of the traffic course. Even for science graduates, the sheer scope and detail of the course can be daunting. There can now be very few occupations left where there is no preparatory course at school or university linking directly with a chosen career but the Telecommunications Traffic recruit is rarely able to use his academic background when moving into his new job.

The TMC intersperses its classroom activities in Islington with periods spent in the recruits' training areas where visits to exchanges and auto-manual centres are arranged. After learning the qualities and capabilities of, for example, a Strowger Director exchange, it is a great help to see the equipment in situ, and thus avoid the misconceptions that a totally college-orientated course could establish. This 'sandwiching' of theory and practice makes the best possible use of the limited amount of study time which is available.

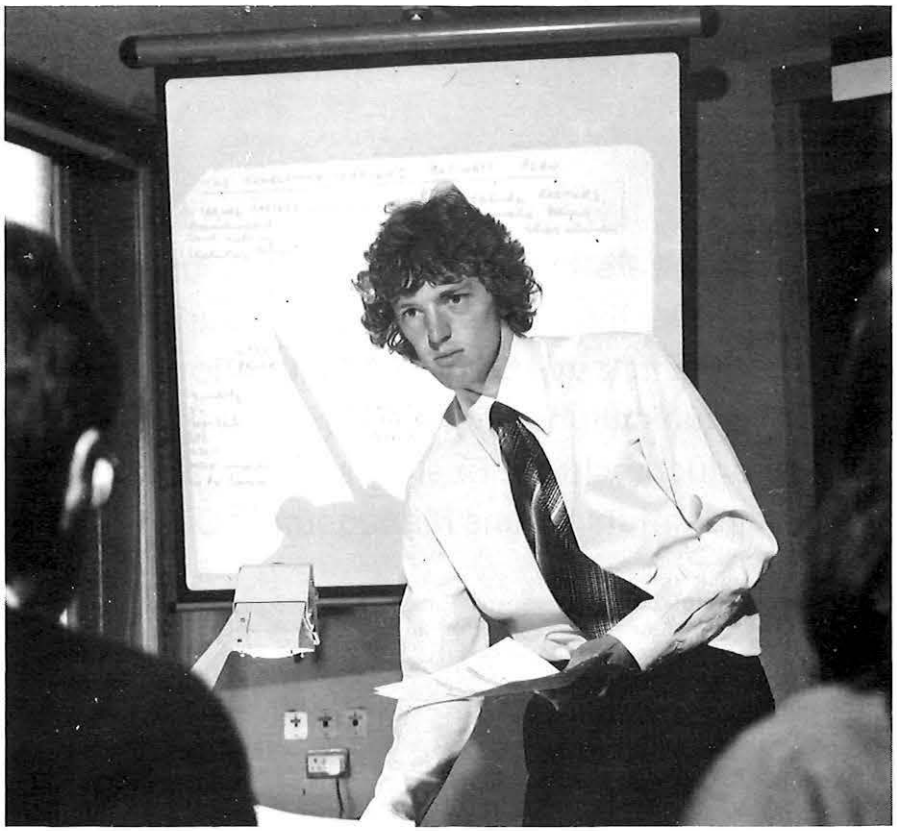
A major part of the course is about exchange management and some time is spent at the South Western Training Centre near the BBC's Bristol complex. Here, the student is given a clear understanding of the difficulties a telephone operator faces – a pre-requisite for efficient exchange management. For those TTSs in the London area, however, the most fundamental difficulty was not the complexity of the switchboard, but the totally indecipherable West Country accent which at times baffled even the most experienced ear!

Throughout basic training, one of the most constantly recurring questions is why people with such different backgrounds had joined the Post Office. Naturally, there were nearly as many reasons as graduates, and these ranged from a desire to work in a public service industry with a progressive outlook, to the chance of working in a Business with growth potential and career security.

It is, however, an undeniable fact that the Post Office is one of the few organisations continuing to develop and expand into new markets, and is making the best use of graduates prepared to work in industry as opposed to the older, more established professions. The often radical approach of the graduate might offend the more conservative and elderly echelons of the Post Office but the experiences of other jobs and disciplines offer the Corporation a stimulating and novel form of management that will see the Business well into the next century.

Below: Peter Harland, who now works at LTR Headquarters, uses an overhead projector to discuss with fellow students in his syndicate the best way to present a case to the full class.

Bottom: A group of TTSs at the TMC compare the facilities offered by PMBX4 and PMBX 10+30 switchboards.



Switching into European data

D E Hadley and A C Barnes

EURONET, the packet switched network which enables data terminals in the nine Common Market countries to gain access to databases providing information in scientific, technical, medical, and other fields and which opens later this year, is unquestionably a multi-national project. Provided by a consortium of each of the EEC's nine telecommunication administrations (see Telecommunications Journal, Summer 1976), it is now being put through final acceptance testing with customers connected on a trial basis.

It was in 1977, following an EEC request to set up the project, that the French telecommunications administration, acting on behalf of the consortium, placed the contract to develop and provide packet switching, multiplexor, and network control equipment. The contract went to a group of companies headed by Société d'Etudes des Systèmes d'Automation (SESA), and Logica UK.

Jointly financed by the EEC and the nine administrations, Euronet is controlled by a consortium management committee chaired by France, and the technical sub-committee is chaired by Mr P T F Kelly (Deputy Director, Network Planning) for the Post Office. Day-to-day project control is in the hands of a team which has included representatives from the Post Office, and the telecommunication administrations of France, the Federal Republic of Germany, The Netherlands and Italy.

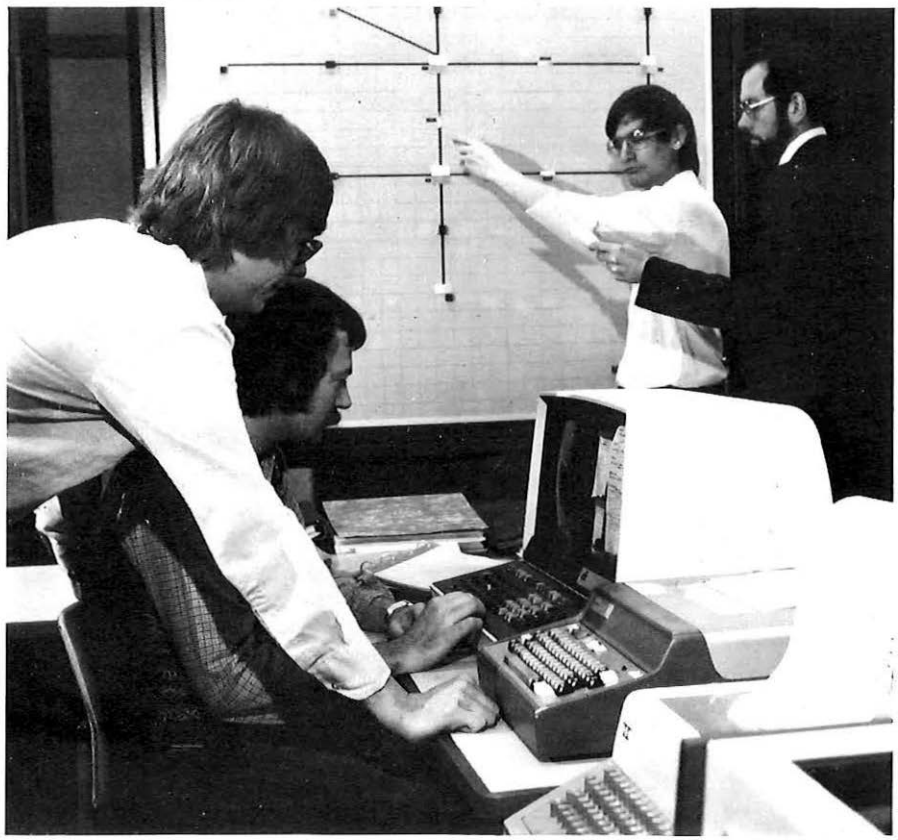
Initially, the network will be made up of four packet switching exchanges (PSES) in London, Paris, Frankfurt and Rome, and there are five multiplexors located in Dublin, Copenhagen, Amsterdam, Brussels and Luxembourg giving remote connection to the PSES. The hub of the network is in London's Electra House, from where Euronet is controlled from a single Network Management Centre (NMC).

It is in fact from Electra House that the International Executive will be responsible for the day-to-day operation and control of the network. A Network Operations Controller provided by the Post Office will oversee the network on behalf of every administration in the project, each of which contributes to the operational expenses of the NMC.

Each PSE consists of a CP50 switch, which provides the packet switching process. Associated with this switch is a duplicated command unit (CU) which controls the setting up of a call and provides accounting and associated functions using a minicomputer. The multiplexors are manufactured in the UK, modems for the 48 kbit/s inter-PSE links and the PSE-MUX links come from Italy, while those for the slower 9.6 kbit/s PSE-MUX links are made in France. Modems connecting customer lines to the PSES have been provided by each administration, thus enabling standard Post Office Datel modems to be used at the London PSE.

The design of Euronet's packet switching equipment is similar to that used for Transpac France's national packet switched service. As Euronet was designed as a private network, the reliability and availability requirements are not as stringent as those for a public network. But Euronet has

Resident French engineer Michael Verdier of SESA discusses a problem with Tony Barnes, THQ Executive Engineer in charge of network acceptance. The display behind them can show at a glance where a problem has occurred. In the foreground tracing the fault are Technical Officer Huw Williams (seated), and from Denmark, Ole Sorensen, also of SESA.



been designed in such a way that by providing more equipment its performance can easily be improved.

Both packet and simple start-stop terminals can be connected to Euronet. Packet terminals present data as packets or blocks of defined maximum length (128 bytes) and they must meet the standards needed to work with the network. They are directly connected to a PSE and can operate at speeds of 2400 bit/s, 4800 bit/s, 9600 bit/s and 48 kbit/s. The Euronet databases will be connected as packet terminals.

Start-stop terminals work character-by-character, being converted into packets on an arrival at the PSE. This type of terminal is used by customers to gain access to the database information. On Euronet, they work at speeds of 110 bit/s, 300 bit/s, and 1200 bit/s, and can gain access to the PSE via the switched telephony network, although direct connections are also possible.

At first, only a few of each type of terminal will be supported, but as the network grows, it will be possible to use the full capacity of each CP50 switch, which can support 250 packet and 250 start-stop ports. And each PSE can consist of a number of these switch modules.

The network can be further expanded, either by providing more PSEs or by replacing a MUX by a PSE. For example, next year, Switzerland will become the first country outside the Common Market to join the network, and will use a PSE installed in Zurich. Spain, Norway, Sweden, Austria, Yugoslavia and Greece have all shown interest in joining the network at some time in the future.

British databases will be among the first to be connected to the network, and already one of these, Infoline, which holds the IEE Inspec Abstracts database was connected during the first week of final acceptance tests. The National Physical Laboratory (NPL) is another already connected and others will include the British Library Blaise service and Oriel. Interestingly, NPL is one of the centres for the existing European Informatics Network (EIN) and all the centres on this system plan to use Euronet. Altogether, about 20 database providers are expected to be connected by the

Technical Officer Bhupa Patel runs hardware diagnostics on the CP50 switch, an integral part of the London Packet Switched Exchange, in Electra House.

time the network opens for business.

The Post Office has been heavily committed to introducing Euronet, and since the network will be controlled from London, it will be making a major contribution to its success. The London-based NMC monitors and controls the whole network, receiving fault alarms as well as accounting and statistical information from all the PSEs. NMC staff will control customer access and will reconfigure the network if equipment fails.

If a PSE fails, the software can be remotely loaded from the NMC. Accounting tapes are sent for common processing to produce billing data for each country. The common processing system has been developed by the Post Office's Data Processing Executive. Euronet calls are essentially charged on the basis of data transmitted, rather than on call duration. They are independent of distances within the EEC.

To help distinguish between the network itself – Euronet – and the services the network offers, the EEC has chosen the name DIANE – Direct Information Access Network Europe for the latter. And under a separate EEC contract, the Post Office has developed a network enquiry service. This will be run on a minicomputer programmed by Network Planning Executive. The enquiry service will allow potential customers to obtain information on services offered by the database information providers and will also provide operational news and details about Euronet representatives in each of the participating countries. Information can be provided and accessed in any one of the six Common Market languages.

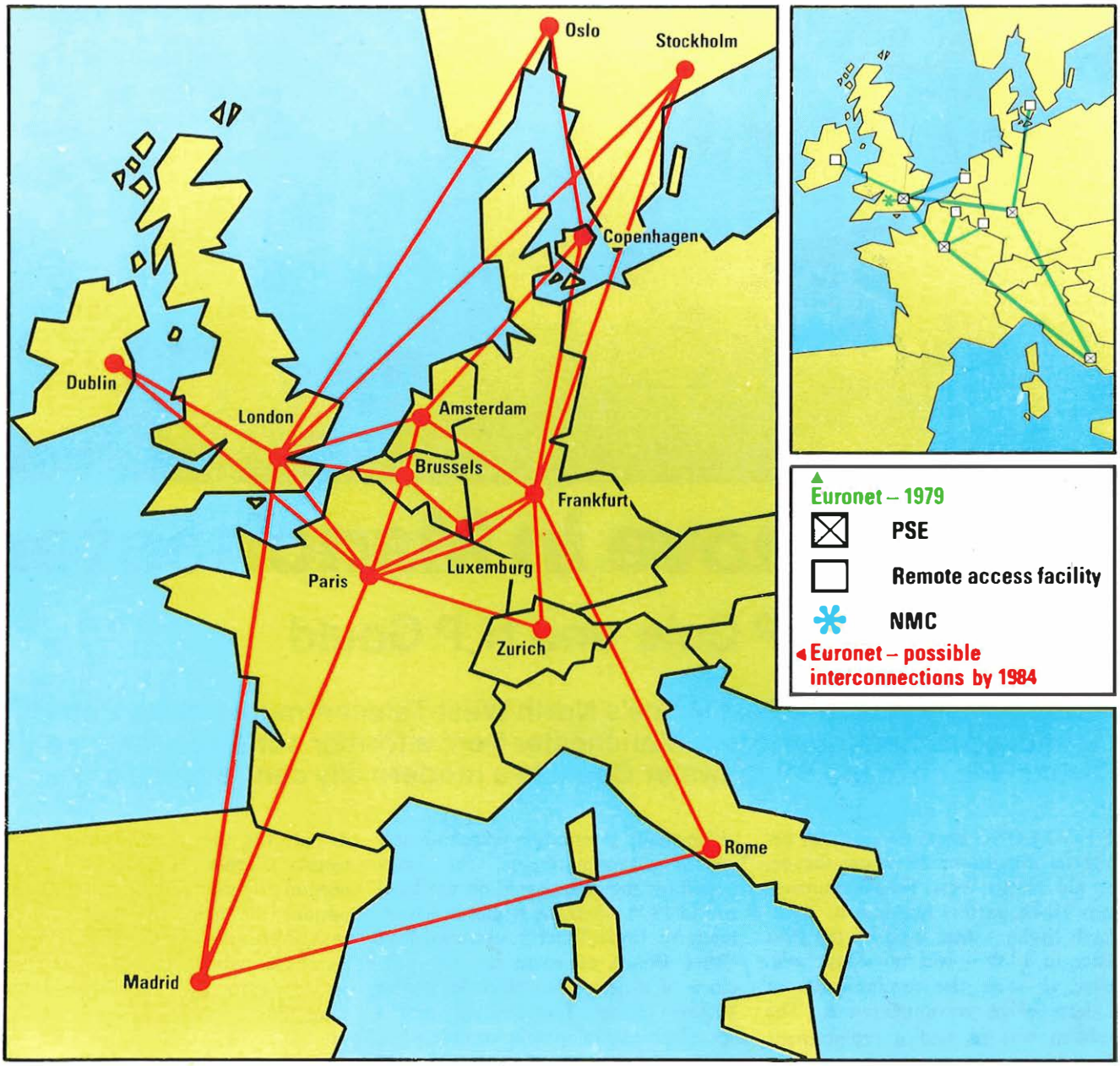
The aim has always been to ensure that Euronet meets international standards and packet start-stop terminals will operate to CCITT recommendations. New standards have recently evolved but plans to incorporate them have already been made.

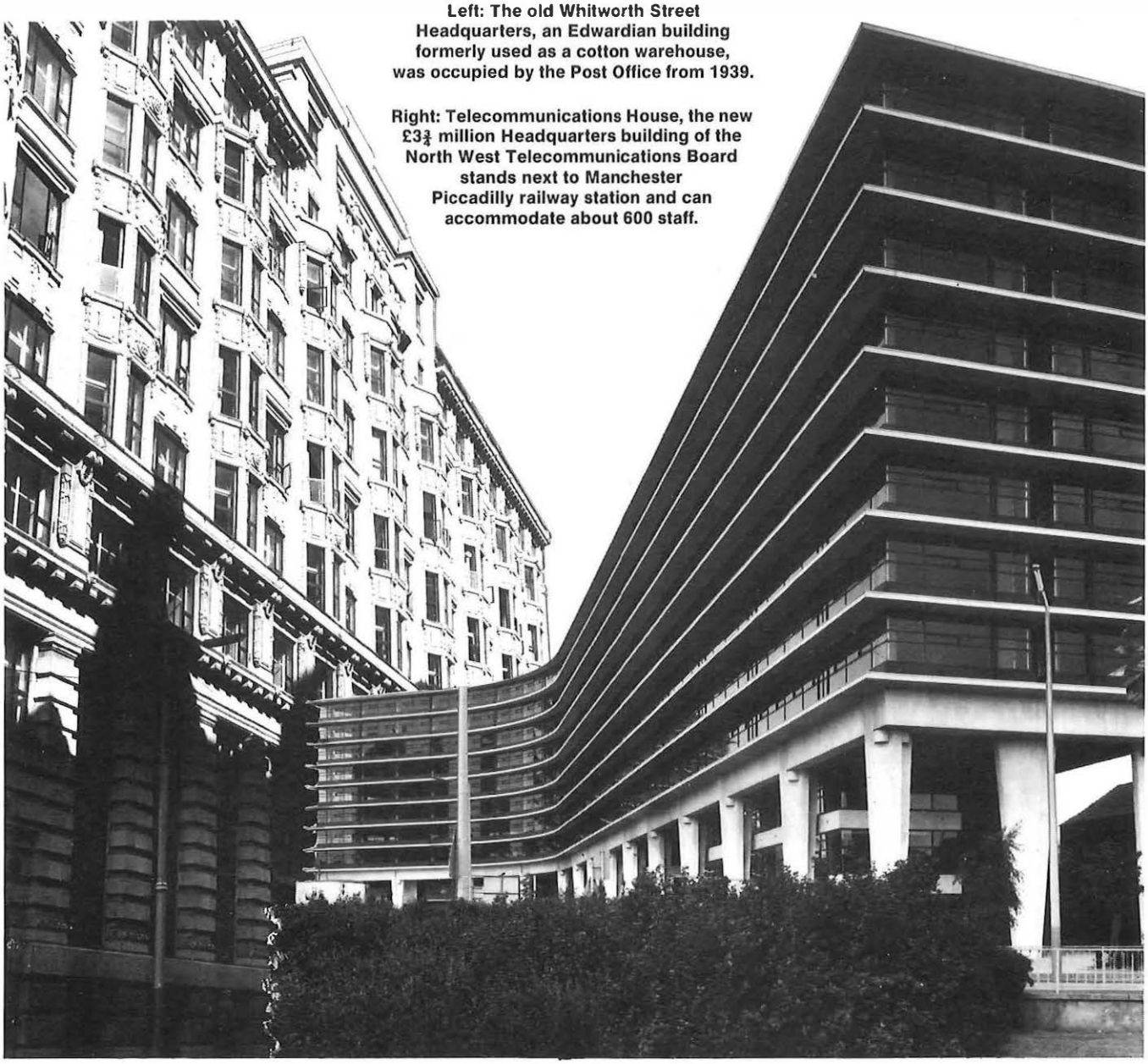
Currently more terminals are in hand and this fact alone suggests that the network will meet the EEC's objective of encouraging the development of more databases throughout Europe.

Mr D. E. Hadley is Head of Section in the Data Systems Planning Division of the Network Executive, and was the Post Office representative on the Euronet Technical Sub-Committee.

Mr A. C. Barnes is an Executive Engineer in the same section, and has been concerned with network acceptance testing on behalf of the Post Office.

PO Telecommunications Journal, Autumn 1979





Left: The old Whitworth Street Headquarters, an Edwardian building formerly used as a cotton warehouse, was occupied by the Post Office from 1939.

Right: Telecommunications House, the new £3¾ million Headquarters building of the North West Telecommunications Board stands next to Manchester Piccadilly railway station and can accommodate about 600 staff.

On the move in Manchester

C P Cole and R P Gould

Earlier this year, the Post Office's North West Telecommunications Board moved its headquarters in Manchester from a former cotton warehouse backing on to the Bridgewater Canal to a modern city centre office block.

IT HAD LONG been obvious that despite its imposing Edwardian façade, the old North West Telecommunications Headquarters building in Whitworth Street – first used by the Post Office in 1939 – was no longer adequate to meet the requirements of modern office accommodation. The problem was to find a replacement which was suitable to all concerned.

Eventually after much searching and several disappointments, the long-hoped for move appeared on the horizon in 1976 when the Regional Chairman, Mr Brian Wherry, obtained Post Office Board approval for the purchase of a new office block known as Victory House. The building was a speculative development completed in 1975, and was on offer for over £5 million for the 18,947 gross square metres of space. After detailed consideration of the cost of all practical options, the Property Services Agency (PSA) were instructed to negotiate the purchase, which they completed in July 1977 for £3¾ million – clearly a sound buy.

It was recognised from the beginning that adaptation of the building to Post

Office needs would not be without difficulties, but the total cost of £600,000 was well in line with the calculations made at the time of purchase. Renamed Telecommunication House, the building is a long, curving, reinforced concrete structure with large areas of tinted glass, and stands next to Manchester Piccadilly railway station. Built in three sections with three podiums, it has eight main floors with additional mezzanine and ground floors, and three shop units.

A small Post Office project team were soon at work planning room layouts for the 600 staff involved. The overall aim was to group staff together by function as far as possible so that communication between staff involved on similar work would be made easier. There was to be a mix of individual offices for senior staff and moderately-sized general offices: a completely open plan design presented difficulties with noise levels and through traffic.

Adaptations by PSA contractors began in April last year while Post Office engineers were busy improving the heating/cooling system which comprises no fewer than 901 individually-controlled reverse cycle heat pump units positioned below the windows around the perimeter of the office areas. Gas boilers in the roof housing were thoroughly checked and power circuits tested. The most complex single job was the installation of the main restaurant and kitchen on the first floor by PSA contractors. This took nine months. Office partitioning took about the same time but with fewer snags. Finally, lighting circuits and telephones were installed by Manchester Central Telephone Area.

Having prepared the building, the next step was the formidable one of transferring about 600 staff, their files and other paraphernalia. The objective was to remove staff as quickly and efficiently as possible at reasonable cost while maintaining effective communication. Having carefully considered the problem, it was decided not to opt for the normal solution of a weekend move where staff would go home on Friday and report to their new office on Monday morning. Clearly 600 staff could not all be moved in one weekend, and the additional expense of paying overtime rates for removal men and porters, coupled with the problem of providing staff to supervise the move for six or seven weekends, ruled it out.

It was, therefore, decided to move on weekdays. This of course, raised other problems, such as the transfer of telecommunications, accommodation for staff while furniture was in transit and keeping staff supplied with work while they are waiting for their new accommodation to be ready. The transfer of telecommunications was handled by Manchester Central Area, who, despite real difficulties provided a more or less instantaneous transfer of lines from the old RHQ to the new.

A practical answer to the problem of accommodating staff on the move was the provision of a 'transit area'. A group of desks was set up in one of the areas of the new building and a telephone was provided for each group with the numbers widely published as

Typical office accommodation in Telecommunications House.

being the transit area telephone numbers. Coupled with a published removal timetable, and backed up by cover provided on the telephones of staff in transit, this ensured that communications were maintained at an effective level, and that staff had a place to work. A temporary registry and typing pool was set up in the new building to serve the transit area and the increasing number of new occupants, and the new staff restaurant was opened at the beginning of the removal programme.

Each week's removal operation was meticulously planned well in advance. The target was to occupy one of the eight floors (plus ground and mezzanine) of the new building each week and this meant that in the case of a typical floor accommodating 70 people, the occupancy of the transit area had to be 'turned round' twice in that week.

For this to be achieved sufficient 'skips' had to be available in time for packing at the old building. (Plastic skips were used for packing files instead of the less convenient tea chests.) There also had to be sufficient labour for packing files and dismantling furniture, enough removal men and vans to effect the transfer from the old building to the new, and enough labour to re-assemble and position furniture in the new building. Transfer of telephones and the commissioning of electrical services had to be expertly timed. This complex cycle had to be repeated without slippage throughout the nine-week programme.

The vast majority of the removals took place during working hours, and advantage was taken of the absence of the Chairman and Controllers at a conference to move all the Board accommodation and its complicated communications facilities. The only items requiring a weekend removal were the Cash Group safe and Pay Group, to ensure continuity of TOLD pay input, and it is a clear indication of the hard work of all concerned – removal contractor, labourers, electric light and power staff, telephone planners and installers, and, of course, the accommodation group, that the target date for completion of the move was met.

Staff co-operated throughout the disruption caused by such a large scale move, and every effort was made to keep every one in the picture by a series of 'Removal Bulletins' and the distribution of individual copies of a booklet about the new building, which was produced to a very high standard in the newly-equipped drawing office and reprographic unit.

Completion of the move is not the end of the story. Work is still continuing on clearing the usual 'running in' faults of a new building, and a furniture respraying programme is well under way. Most people, however, seem content with the improved accommodation, and effort is now being directed towards ensuring that the high standards achieved will be maintained.

Mr C. P. Cole is Head of Office Services and Board Secretary for NWTB.

Mr R. P. Gould is now Head of Personnel in Portsmouth Telephone Area but was Head of Estates Group in the Planning Division of NWTB.

In peril on the sea

THE STORM tragedy which wrecked August's Fastnet yacht race claiming 17 lives has once more underlined the vital role of Post Office Telecommunications when disaster strikes at sea. The unstinting efforts of staff from Plymouth Telephone Area and Land's End Radio Station ensured a smooth flow of information not only to and from the rescue services but also to anxious relatives throughout the world.

Concern about the 302 yachts, which had set out from Plymouth for the gruelling six-day race round the Fastnet rock south of Ireland, mounted as the weather worsened, and soon many of the crews were in difficulties. This was confirmed when the coast radio station at Land's End began receiving messages from larger vessels in the area that they had seen some of the yachts in trouble.

Land's End Radio Station, recently moved from St Just to Skewjack, was to become a focal point for communications for many of the tragic messages. Recently modernised at a cost of £92,000, it was, during the storm, in touch with warships, helicopters and even an RAF Nimrod reconnaissance aircraft which played a major role in identifying some of the yachts and their crews.

As the storm reached its peak, with 70 mile-an-hour gales and 40 ft high waves, emergency services were in full swing. Nearby Culdrose Naval air station was alerted and ships in the area went to assist. With a usual day duty staff of five, Land's End station manager Lawrence Lawry had to call on volunteer help to cope with the surge of traffic generated by the emergency and make sure the messages kept flowing.

Meanwhile, on land, demand for information was pouring in, not only from relatives and friends of the crewmen, but also from the media. This put great pressure on telecommunications services. Plymouth Telephone Area had already provided 17 additional lines, not only for the Press, but also for the organisers, the Royal Ocean Racing Club. Temporary lines had also been provided for the Royal Western Yacht Club. And at one stage during the night of the emergency, congestion through Plymouth exchange was so bad that callers were only half way through dialling numbers before they reached an engaged signal.

The usual complement of night telephonists at Plymouth was joined by several more, specially called from home to help handle the emergency. In 10 hours, operators dealt with 212 calls connected with the drama. Three of the operators staffed special positions to deal with enquiries from relations. Later, a back-up information centre was set up at the exchange, and plans were made for telephonists to be armed with a computer printout giving the latest information on the distressed yachts. But in the event, this was not needed.

The last word comes from Alan Green, secretary of the Royal Ocean Racing Club: "The telephone service in Plymouth responded magnificently and with great efficiency – all concerned in the sailing world were most impressed."

● Although several Post Office staff were crew members on various yachts, none received serious injury.

PO Telecommunications Journal, Autumn 1979

System X dominates the British Telecommunications stand in Geneva – and attracts the visitors.

Britain steals the show

THE BEST EQUIPPED, the most eye-catching and by general acclaim, the star attraction of the show . . . that was the verdict of organisers, potential customers and competitors alike on the British Telecommunications stand at the TELECOM 79 exhibition in Geneva which saw the world's leading telecommunications equipment manufacturers displaying their wares with exhibits ranging in size from microprocessor-controlled telephones to satellite earth stations.

With few exceptions the exhibition was organised on a country-by-country basis and while most countries had some degree of design co-ordination such as a common colour scheme, the British stand stood out as a co-ordinated whole with each individual display part of an overall plan.

At the heart of the display – a joint venture between the Post Office, GEC, Plessey and STC – was a working model of System X, Britain's all electronic digital exchange system for the 1980s which was making its world debut. Three exchanges, a small medium local exchange, a remote analogue concentrator and a stand-alone digital concentrator worked continuously throughout the six-day exhibition and attracted much attention.

But impressive though System X proved, there was, of course, much else on show which aroused universal interest. Visitors were able to make calls on a number of New Generation Telephones – connected to the System X exchanges – and staff demonstrated the advanced subscriber and operator facilities provided by a modern computer-controlled exchange.

Typical was the storage of frequently used numbers which could be recalled by using a one or two digit code and what proved particularly impressive was the voice guidance technique which helps subscribers set up their own special facilities.

A comprehensive selection of digital transmission equipment was on show working at bit rates from 2Mbit/s to

140Mbit/s on both cable and optical fibre systems and customer equipment featured ranged from a variety of sizes and shapes of telephone through small business systems to Customer Digital Switching System 1 (CDSS1), marketed as the Monarch 120 in the UK, an all-digital PABX which was connected to the Swiss network. Many of the telephones on the stand were, in fact, connected to CDSS1 and this enabled many advanced subscriber and operator facilities to be demonstrated.

Throughout the exhibition Measurement and Analysis Centre (MAC) equipment monitored the performance of four exchanges in the south of England and Automatic Call Recording Equipment (ACRE) – currently on trial at Eastbourne – was displayed. This was one of the few items at the exhibition showing the advantages of advanced facilities for operator services which remain a continuing need in an all-digital network.

Radiopaging, aids for the handicapped, Prestel, facsimile, Alarms by Carrier and Confravision were other Post Office services prominently featured and demonstrations of slow scan television, digital local lines, optical fibres and microelectronics were given by Research Department staff. Also on hand at all times were staff from the Post Office Consultancy Service, Telconsult.

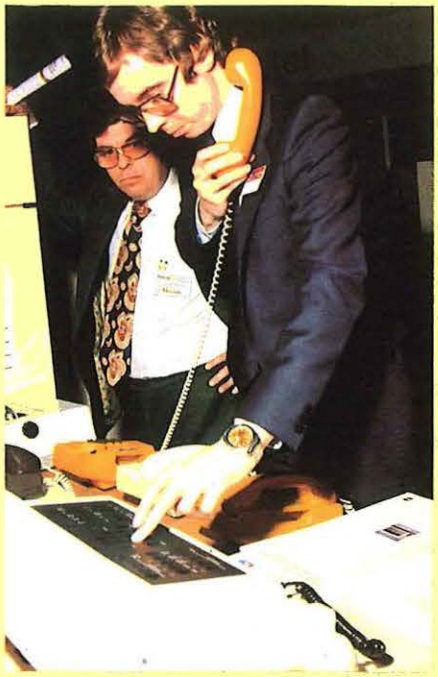
Highlight of the exhibition from the Post Office's point of view was British Day when HRH The Duke of Kent toured the stand with Sir William Barlow, Chairman of the Post Office.

Undoubtedly one of the most useful aspects of the exhibition was the opportunity it gave to compare notes with foreign manufacturers and administrations. The overall conclusion was that although in many cases they were displaying impressively advanced equipment it was a fact that in virtually every field the British were at least on a par, if not ahead of them.

Certainly by the time the last demonstrations had been given and visitors had moved away, no one doubted that the efforts which had gone into the planning, building and manning of the British stand had paid handsome dividends. Indeed as one senior Post Office man said: "We took on the world at Geneva and won."

Right: HRH The Duke of Kent, Vice-Chairman of the British Overseas Trade Board, is introduced by Post Office Chairman Sir William Barlow to Dr T H Flowers, one of the pioneers of digital transmission. Post Office Board Member Sir George Macfarlane looks on.

Right: A visitor tries his hand at the CDSS1 Call Connect System, a medium-range digital PABX, manufactured for the Post Office by GEC and Plessey. The system is being marketed in the UK under the title Monarch 120.



Below: It's all for the birds! At least, that's what Buzby seems to be chirping during a short, but well-earned break on the British stand. Under the feathers is Keith Gleen, a hardware maintenance engineer on System X. And adding glamour to the occasion are four 'Beefeaters', on the stand to help visitors.

Left: Mr Trevor Harvey, a Head of Section in the Business's Marketing Executive, shows visitors how the telecommunications industry plays its part in making life easier for the physically handicapped.

Above: Japanese visitors pay close attention to an explanation of System X working during TELECOM 79.

Left: Mr Christopher Chataway (right), a former Minister of Posts and Telecommunications, and newly-appointed Chairman of British Telecommunications Systems Ltd, exchanges views with demonstrator John Flint and John Sharpley (left), managing director of British Telecommunications Systems. The company was set up jointly by the Post Office, GEC, Plessey and STC to promote System X exports.

Yesterday's men of vision

J A Hudson

RECENT YEARS have witnessed spectacular progress in the world of telecommunications. New technology and equipment have led to the development of such major advances as System X, optical fibres and satellite communications, and with silicon chips and microprocessors becoming more and more sophisticated, the future promises an even greater degree of excitement.

But is it really only in modern times that so much has been achieved, and that horizons have been so broad? A little research indicates that the answer seems to be a resounding 'no'. A glance back into history at some of the ideas put forward in the days of the telephone's infancy show for instance that many of the early pioneers were also men of great vision. In short, the proliferation of telecommunications services today is, in some cases, little more than what was envisaged soon after the telephone was invented just over 100 years ago.

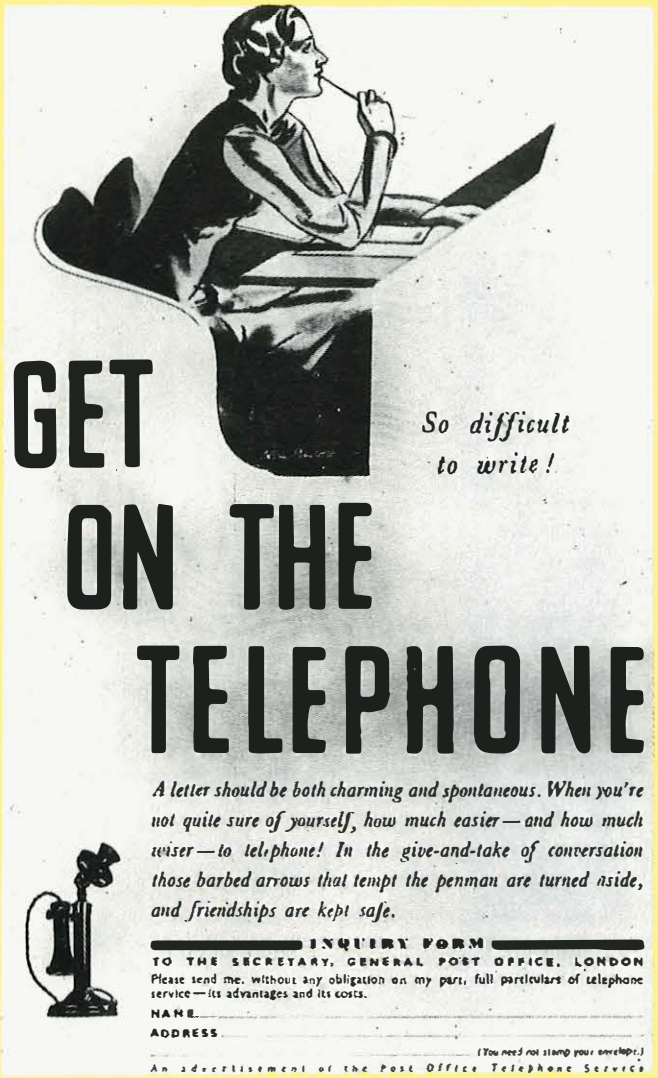
In those days, however, progress was not so quick. In the very early days, not everyone accepted the telephone's possibilities and there were still many who were prepared to dismiss anyone hearing voices from afar as mad. Indeed, a New York newspaper of the time reported that as it was well known to informed people that the human voice could not be transmitted over wires, extracting money by claiming otherwise amounted to fraud!

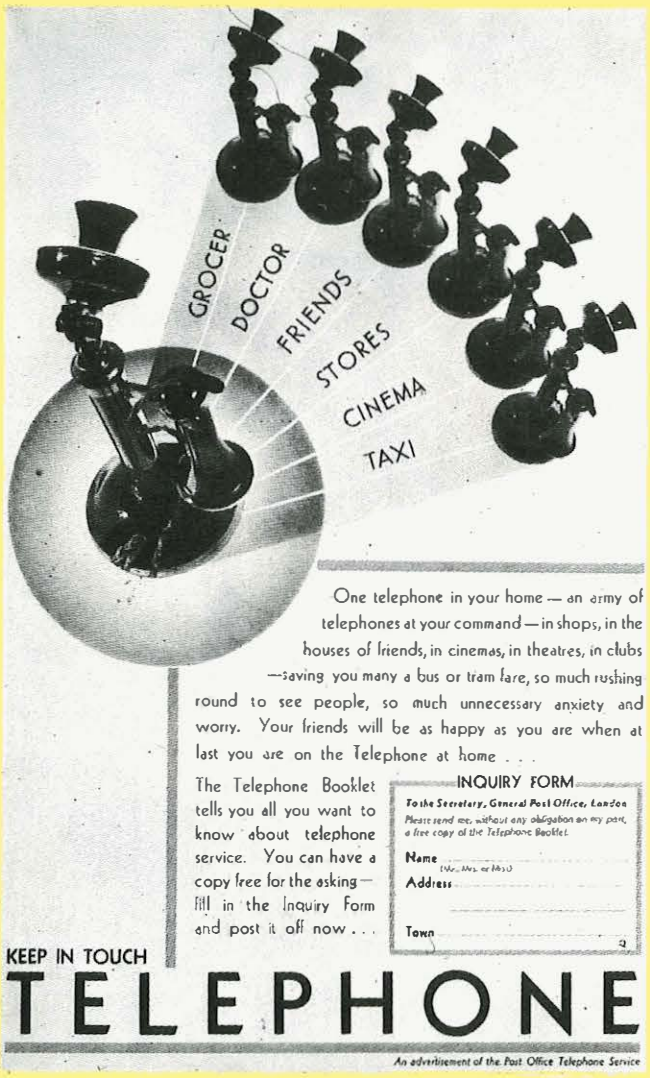
And surprisingly even the telegraph companies were a little slow to appreciate the telephone's potential and declined to purchase Bell's patent in 1876, dismissing it as an "electrical toy" and preferring their own vision of a future in which a telegraphic device would one day be found in every American home. Subscribers would communicate with each other in Morse code.

It was against this background that Bell faced a hard marketing problem for his innovation. To convince Americans they needed the telephone, they had first to be taught what to use it for. In 1877, two broadsheets emphasised that "conversation can easily be carried on after slight practice and with occasional repetition of a word or sentence". They even listed 180 useful people such as butchers and doctors to call.

In the early days too, some users suffered from 'stage fright' when using the telephone, while others were worried about developing a 'telephone ear'. The solution, as one prophet

The approach to advertising the virtues of the telephone in earlier times was very different from today's sophisticated campaigns which are seen by millions throughout the country on posters and television.





wrote in 1876, was to "increase the intensity of the effects so that a whole room should be able to listen to the sounds produced". Allegedly, a telephone which did precisely this was invented in 1890 although customers had to wait a lot longer before a loud-speaking telephone became commercially available!

Gradually, the telephone became more widely accepted and soon the scientists and engineers began to develop refinements to the now fast expanding basic service. Before long, some customers were able to enjoy the benefits of a variety of 'announcement services'. For instance, the Telephon Hirmondo in Budapest around 1893 had 6,000 subscribers who listened to news, music, Parliamentary extracts, plays and language lessons. Interspersed with advertising, the system claimed to fill all the functions of a daily newspaper.

Paris in 1884 had a "theatrephone" service, and in 1894, some London subscribers were offered a choice of a line to one of 30 theatres. Although these facilities were to be replaced by the radio, their wide scope compares favourably with today's cable television services operating in parts of American which also provide subscribers with many local interest and specialist broadcasts.

Many customers on rural exchanges had an even more selective form of "phonecasting". It was customary, in America at least, for operators to pass on to subscribers any news – or gossip – of particular interest to them. This informal service soon became impossible to run as numbers of subscribers rose, and it is interesting that only now can the automatic equivalent be contemplated on a wide scale in the form of specialised news phonecasts to match subscriber's declared interests – such as volcanic activity or South American politics.

Above: Early examples of the telephone. Below: The equipment may have been primitive but even at the turn of the century there were plenty of ideas about how the telephone service should develop.

Although today's operators may pass on messages to doctors, the only generally available service in this tradition is the alarm call. Potential exists, however, for future operators to provide a message relay service far beyond those early operator services. A computer could direct unanswered calls to an operator who would take the message on tape. The subscriber would then phone the computer at any time to hear all the messages in his or her file. Futuristic as this might seem, it is essentially a development of a tradition that existed in the very earliest days of the telephone.

It can be seen, therefore, that the early telephone subscriber with his push button instrument – the dial was not invented until 1896 – potentially had an exciting range of manually provided services. Bell's 1876 "triple mouthpiece" telephone, for example, was presumably an early attempt at a conference call.

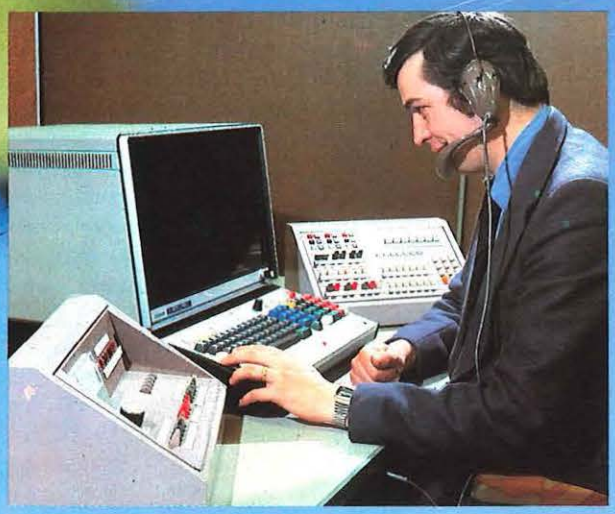
One thing several early subscribers were not satisfied with however was the way the telephone invaded solitude. Today, we are perhaps more used to the idea of being always on call, but as early as 1878, Mark Twain was complaining that no-one had invented a muffler or gag for the instrument. Similarly, H. G. Wells wanted a "one-way telephone" so that he could ask for news when he wanted it, but not be forced to listen to the bell ringing when he was not in the mood for talking.

Perhaps many today still share his view. After all, a few years ago it was established that about one fifth of engaged signals were the result of people deliberately trying to avoid unwanted intrusion. Happily, "subscriber controlled selective barring" will soon give customers that "gag" facility.

Certainly, the coming of the telephone has had a profound effect on society but today's scientists and engineers working with sophisticated and exciting technologies are only following a tradition firmly established almost a century ago.

Mr J. A. Hudson is an Executive Officer in Telecommunications Pay and Grading Department. He is particularly interested in the development of telecommunications in society.

In good repair



Left: Telephone engineers at work at a manhole tracing a fault in an underground cable.

Inset: The type of equipment which will be used when the Post Office begins field trials of a computer-aided Repair Service Control.

Above: Keeping the customer happy is an important part of the Repair Service. Here an engineer calls on a housewife ... and repairs a bell circuit fault on her telephone.

Continuing our series of articles on the background to the published figures by which total customer telephone service is measured,
Mr D W R Cobbe,
Head of Customer and Ancillary Services Maintenance Division in THQ Service Department outlines the work of the Repair Service.

TO DEAL directly with a faulty telephone at a subscriber's premises, to find and correct the fault and thus hopefully earn the gratitude of a thankful customer is a rewarding job combining – as it does – both human and technical involvement.

Naturally there are occasions when all is not sweetness and light and the Post Office is the first to admit that mistakes are sometimes made and that there is genuine room for improvement. On the whole, however, there is much evidence from customers that they do frequently receive and appreciate a quick response to their fault report and a rapid restoration of their line to good working order.

The running of an efficient Repair Service is dependent on many factors but none more important than the staff and the way in which they and their work are organised. This is vital and is nowhere better illustrated than at the Repair Service Control (RSC) which is the hub of the whole operation. Customer reports of faulty telephones or other equipment and of poor service, such as wrong numbers or noise on the line, are made either directly to these Controls or, indirectly, via the enquiry Operator Service.

Receiving these fault reports, recording them on dockets and registers, testing the line, distributing the faults to repair staff, receiving reports back of fault clearance, notifying the customer that his line is working and finally clearing the docket for control and statistical purposes, are all tasks carried out by RSC staff. They must also maintain customer information and fault history records.

Reception should clearly take place at a point where information is available on the ability of the repair service to respond to the customers' requirements. Information on faults already received but not yet cleared also needs to be available at the reception point so that subsequent enquiries on progress can be efficiently handled. There are occasions too, when testing at the moment of reception can be an advantage but this technique is still in its early days although it is a clear objective to extend this facility.

Reception staff need particular aptitudes like patience and tact – not least because all their customers are experiencing difficulties – together with a degree of knowledge of the system. This will enable them to find out as much as possible about the fault in

their conversation with the customer.

Testing of lines which uses special apparatus is an interesting exercise. Not everyone knows, for example, that a test from an RSC can prove the 'serviceability' of a line right up to the telephone instrument and even identifies that a bell is connected. There are, however, limitations, and visits to customers' premises are frequently necessary for complaints such as 'faint hearing'.

The tests applied can also identify fairly readily cable faults and some exchange equipment faults. In all these processes some faults are readily identified by the tests, while there are others where interpretation and engineering judgement are needed. The point of the test is to determine whether a faultsman dealing with customer apparatus or one dealing with the cable/line circuits is required. A third possiblity is that an exchange faultsman is needed.

The process of clearing faults is linked to their distribution. To maintain efficiency and effectiveness, Fault Distribution Officers have to take account of test results and information obtained from the customer and be aware of the need to minimise travelling for faultsmen who are often required to cover a wide territory.

Currently there is an inevitable amount of clerical work concerned with the formation and maintenance of customer records and fault histories together with the recording and preparation of statistics which are needed to ensure the organisation is running effectively and meeting its service performance targets. From a service viewpoint there is obvious scope for the application of computers presenting information on visual display units (VDUs) to RSC record-keeping and handling of fault reports.

This would improve the accuracy of records and enable rapid advice to be given to a customer enquiring about his fault, as well as removing the drudgery of clerical effort. Such computer assistance would need to be 'on line' and the cost of such systems, while being a factor, is far from being overriding where improvement in customer service is the prime objective.

Other administrations particularly in North America, already have a number of such systems in operation, and the Post Office is making preparations for the field trial of a computer-aided RSC. A blank fault report will be displayed on the VDU which will require completion by keyboard operation at the reception stage. The electronic fault docket will then be moved electrically about the RSC and updated as each stage of the fault clearing process is reached.

So much for the Controls – but what happens outside? The repair service deals with some 15 million reports each year. About 40 per cent of these are attributed to customer apparatus (including PABXs), just under 20 per cent to the external plant, a little over 10 per cent to the exchange equipment and for nearly 30 per cent of reports, engineers are unable to find any tangible faults.

The work of the repair service is growing in complexity by virtue of the ever widening variety of customer equipment now in service. This includes the full range of telephone instruments as well as telegraphs and

Nimble fingers are an asset in the repair of many telephone cable faults.

Datel services which are also of great importance. To all this will shortly be added a veritable explosion in new types of telephone, with loud-speaking, auto-dialling and other facilities.

Clearly it is not possible for any individual to maintain effectively such a wide range of apparatus and some specialisation has been introduced to cope with coinboxes, PABXs, telex and Datel services. Despite this, however, an unusual degree of versatility is still demanded.

Maintenance of external plant is another aspect of repair service work requiring specialist skills because of the high degree of complexity of the plant. This is coupled with the need to operate a variety of test gear to locate both the plant and any faults in it and for the detection of air-leaks in cables which are subjected to air pressure to ensure they remain dry and the conductors well insulated. Conditions are rarely ideal with manholes often full of water. There are, of course, always more faults when the weather is poor.

Finally there are exchange/network faults usually on highly sophisticated apparatus which are frequently elusive, intermittent and complex.

But let us now consider the customer. Naturally he is little concerned and mostly unaware of the Post Office's problems. How he sees the Business therefore, depends very much on his personal experience which to him is far more relevant than any set of statistics.

For various reasons in recent times the Post Office has not met even its own targets, but it knows it is presently capable of clearing 85 per cent of all reported faults by the day following the day of report and it knows it should improve this to 95 per cent. It certainly intends to do so.

It is recognised, however, that even in an improved general situation there is a need for procedures to deal with the occasional case of a long duration fault or repeat fault. Here, the RSC and field inspection work plays a significant role in these circumstances through operating special investigation procedures where repeat faults occur and through ensuring a good standard of repair.

To deal with excessive delay, the Post Office is starting a five-day maximum fault duration target – the count to include Sundays. This is not a satisfactory target from a customer's viewpoint, but at least it is a base from which to start. The idea is that there should be an absolute limit to fault duration. Once this is underway it is hoped to improve on it.

Another important aspect in the drive to improve customer service is the fresh look now being taken at operational methods, organisation and the facilities which ready access to computer data can offer. There is plenty of scope for development in this area.

Certainly successful operation of the Repair Service is not only essential to maintain the telephone network but it is important, too, that it should give millions of Post Office customers confidence in the Business's ability to act quickly and efficiently.

Technical Officer Ian Smith verifies a customer fault report at the London Datel Test Centre.

Putting Datel to the test

R G Rothery

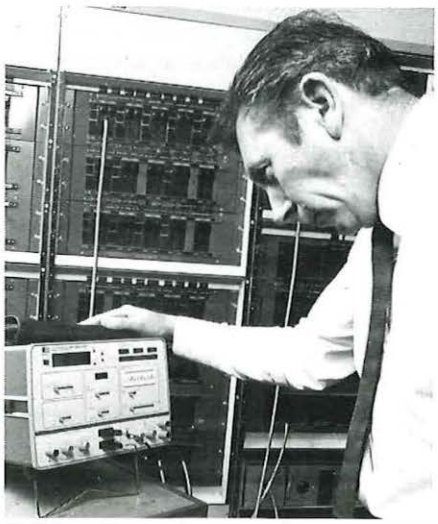
A network of Post Office Datel Test Centres which enable fault testing of modems to be carried out over the public switched telephone network from a centralised point is now well established.

DATA COMMUNICATIONS services marketed by the Post Office known as Datel, consist, in their simplest form, of a combined modulator and demodulator known as a modem which is fitted at the Datel customer's premises and connected to either an audio bandwidth private circuit or a telephone exchange line. The modulator section converts the serial binary data signals supplied by the customer's data terminal equipment (DTE) into an analogue form suitable for transmission over the telephone network. At the distant end the demodulator converts the received analogue signals back to serial binary data form for presentation to the customer's receive data terminal.

The complexity of a Datel service grows quickly when customers need to communicate with many distant terminals using either multipoint circuits or time division multiplex (TDM) systems to combine the data from many channels for onward transmission via a single private circuit. Multipoint private circuits allow a customer's central processor to address and communicate with up to 12 customers' outstation locations.

Using TDM systems, customers remote from a computer gain access to it over the public switched telephone network (PSTN) at local call charging rates. Demand for Datel services is expanding at a rate related to the huge increase in the use of computers in society generally and further significant increase in demand can be expected if the potential growth of Prestel, private viewdata, packet switching, and cashpoint services are realised.

The special needs of business customers who rent Datel or allied services in relation to the maintenance service they require is also changing because in many cases, they are becoming more and more dependent on data communication for all or a major part of their business activities. This situation poses special and increasing problems to the Post Office data field service organisation as customers demand a rapid response when faults occur.



Datel services maintenance Executive Engineer John McKenna checks private circuit line parameters with a data line analyser at the National Westminster Bank Computer Centre.

To meet this demand and cope with the rapid Datel expansion now taking place, the Post Office must review continuously the necessary maintenance procedures. Further, to ensure that future, more

complex services or networks now being considered can be effectively maintained when introduced into service, it is essential for maintenance requirements to be considered at a very early stage in the development or planning process.

Testing and diagnosing fault conditions on data communication systems pose special problems separate from those which affect normal telephone service. The customer expects the network to transmit his data information with a minimum number of errors but it is not possible to produce a completely error-free transmission system over plant whose primary purpose is to provide a speech service.

A compromise occurs in practice where customers design their data systems and operating procedures so that the occasional error does not seriously disrupt their operation or they build in error correction and retransmission facilities to overcome the inherent error conditions.

Errors occurring during data communication over a telephone circuit are produced by various transmission impairments which are almost impossible to eliminate completely. These impairments are not usually a serious problem to lower speed Datel services but their elimination is of major importance in obtaining an adequate quality of service for higher speed services.

Impairments such as poor frequency response, excessive transmission losses or low signal-to-noise ratio are more critical to the performance of the higher speed data circuits but there are other transmission impairments to which these services are particularly sensitive and which do not seriously affect a normal telephone call.

Phase jitter, for instance, is an impairment introduced by a telephone connection which results in a continuous variation of expected time instants of a defined signal condition. Performance is also affected by noise impulses which are short bursts of noise introduced into the telephone circuit but which would appear as clicks during an ordinary telephone call, and drop outs, which are short breaks in transmission, which would normally go unnoticed in a telephone conversation.

Other impairments include group delay distortion which is the variation in transmission time for the different frequencies within the transmission band of the circuit. This impairment goes unnoticed in a telephone call but affects the time at which inter-related frequencies making up an analogue data signal arrive at the receive terminal. It results in distortion and the possibility of errors in the demodulated data information signals. Rapid changes in gain occurring in the telephone connection referred to as amplitude hits also affect performance and these introduce clicks in a normal telephone conversation.

These impairments can occur anywhere in the inter-connecting telephone circuit transmission and switching systems and result in the need for special test equipment to enable the performance of the telephone circuit to be measured and faults diagnosed in data impairment terms. The Datel modem equipment also needs special test facilities to diagnose equipment problems and to measure overall system performance in digital data terms between the customer's terminals. This parameter, of course, directly affects the customer, but if performance is bad it is usually due to poor performance in respect of one or more of the transmission impairments already described.

There is a need, too, to test the interface control protocols which are the operating rules defined at the modem digital interface. Tests are needed to ensure that customers' data terminals are operating to these rules and also to recognise fault conditions which in this case could be either in the Post Office equipment or in the customer's terminal.

Facilities provided in present speech-band Datel service modems allow for certain limited tests of modem performance to be completed remotely, by accessing the circuit via the PSTN from a remote point known as a Datel Test Centre. The Datel Test Centre (DTC) is equipped with a Post Office modem of each type at present in service and facilities are provided to switch manually the type of modem required to match the customer's service, into the test circuit as required. To cope with the necessary tests the Datel Test Centre is equipped with Datel testers, frequency counters, oscilloscopes and transmission measuring equipment.

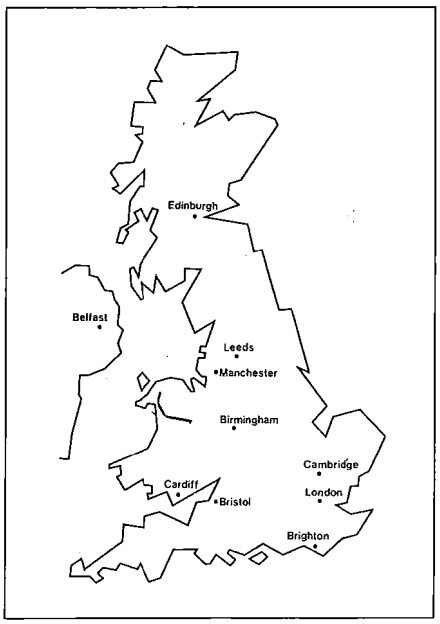
There are currently 11 Datel Test Centres in the UK including one provided for international services and each has Datel testing responsibilities for all Datel services with PSTN access within its territorial Region. Normally a DTC receives its fault reports from the customer's local fault-reporting point, which may be a Repair Service Control (RSC), or a Trunk Maintenance Control Centre (TMCC). Before passing faults to the DTC the fault reporting point will have carried out DC and/or transmission tests to prove the line plant and if a line fault is found, the circuit is treated as a normal telephone circuit and the DTC is not then involved.

After a fault is accepted by a DTC subsequent to the line being proved satisfactory, and where PSTN access to the modem exists, the DTC is responsible for accessing the circuit and carrying out tests of the remote modem. To complete these diagnostic tests the customer's co-operation is obtained, by speaking over the telephone associated with the modem, to disconnect his data terminal equipment by removing the interface plug and operate a test button or key under instruction from the DTC. Under these conditions the output of the modem's demodulator is looped to the input of its modulator and the modem is connected to the line in a two-wire mode.

The DTC can then send data signals from a Datel tester to the customer's modem and check that correct signals are being returned thus confirming whether the demodulating and modulating functions of the modem are operating correctly. These facilities speed diagnostics and reduce the number of abortive visits to customers' premises as major modem functions or customer misoperation can be checked before the field maintenance officer is dispatched. The majority of modem faults are, in fact, diagnosed by these tests.

If a Datel equipment fault is proved, the DTC hands out the fault to the appropriate Area Datel field maintenance staff, who are responsible for repair of equipment faults in customer's premises. There can be little doubt that DTCs throughout the country are now a vital factor in the successful maintenance and operation of Post Office Datel services.

The Post Office's Datel Test Centres.



Mr R. G. Rothery is a Head of Group in Network Maintenance Division of THQ Service Department with responsibility for the maintenance of Post Office Datel services.

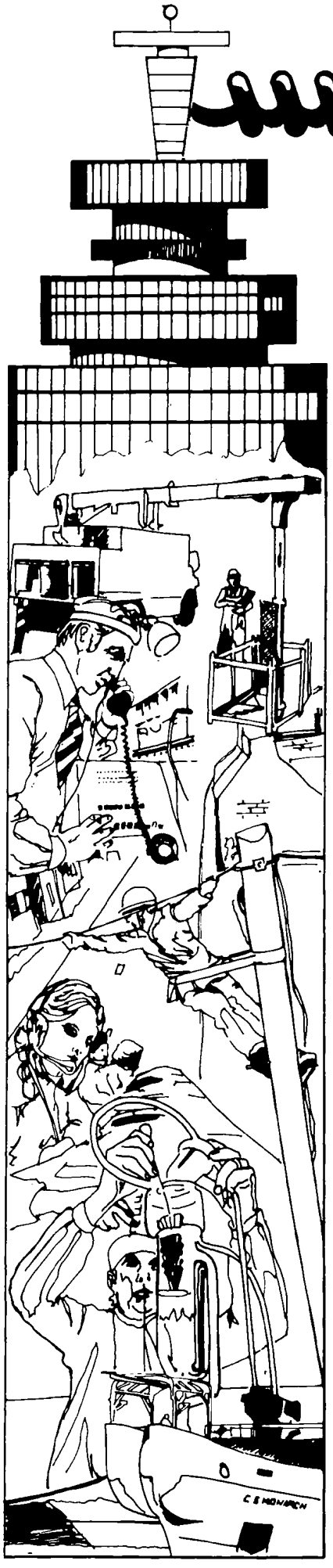
PO Telecommunications Journal, Autumn 1979

The Year in Figures

A Review of Post Office Telecomms Progress in the year 1978/79

	1978-79 Result	% Growth over 1977-78	1977-78 Result	% Growth over 1976-77
TELEPHONE SERVICE				
Size of System				
Total working connections	16 359 000	8.5	15 073 000	8.0
Total working stations	25 020 000	7.6	23 261 000	7.0
Call office connections	77 000	0.0	77 000	0.1
Shared service connections	1 555 000	−1.5	1 579 000	−8.9
Growth of System				
Net demand for connections	2 195 000	16.7	1 881 000	32.0
Net supply of connections	1 944 000	10.9	1 753 000	23.2
Penetration				
Stations per 1000 population	Not available		415	6.1
Traffic				
Inland effective calls: trunk	3 022 000 000	11.8	2 703 000 000	10.1
Inland effective calls: local	16 100 000 000	10.3	14 600 000 000	8.2
Continental: outward calls	63.0	19.6	52.7	24.4
Inter-continental: outward calls	23.9	34.2	17.8	46.0
Telephone usage				
Calls per connection	1222	2.1	1197	1.6
Calls per head of population	Not available		310	8.4
Local exchanges				
Total	6231		6231	
Strowger	4717		4917	
Crossbar	485		424	
Mixed Strowger/Crossbar	46		37	
Electronic	973		841	
Mixed Strowger/Electronic	10		12	
TELEX SERVICE				
Size of System				
Total working lines	80 000		72 000	
Traffic				
Inland calls	83 190 000	11.0	74 913 000	10.5
External outward numbers of minutes	187 799 000	11.0	158 755 000	3.9
TELEGRAPH SERVICE		18.3		11.9
Telegrams				
Inland	3 281 000	2.5	3 201 000	−6.9
External: UK originating	4 677 000	−5.2	4 934 000•	−4.5•
UK terminating	4 420 000	−6.5	4 729 000•	−10.0•
UK transit	3 956 000	−5.5	4 186 000•	−8.9•
TELECOMMS STAFF				
(Part timers count as half)				
Telecomms HQ (inc Research, Development and Procurement)	24 477		23 948•	
Regional HQ	12 951		12 879	
Telephone Areas	196 019	2.2	191 539	19.1•
Total	233 447	0.6	228 366•	−1.2
		2.3		−1.7
		2.2		0.1•

•Amended figures



A healthy situation

In this, the eleventh in our series on some of the many jobs essential to the efficient operation of Post Office Telecommunications, Dr Peter Taylor outlines his role as the Corporation's Chief Medical Officer

THE telephone rings in a large, tastefully decorated office on the fourth floor of Central Headquarters in London. It is still early but already the business of another unpredictable day has begun.

On this occasion the call is from one of the two dozen strong team of Regional Medical Officers who, together with support from some 75 nurses, form the backbone of the Post Office's still-developing Occupational Health Service. But it might equally well have been from an existing patient requesting an urgent consultation or perhaps, from the Chairman's Office.

Certainly in my particular job there are no two days the same and the establishment of a set routine is well nigh impossible – which is perhaps how it should be anyway.

By choice my day begins very early. I travel into London from the heart of rural Suffolk and a 6am start is the order of the day. Obviously the train journey gives me valuable reading time.

Since coming to the Post Office in 1971 from the London School of Hygiene and Tropical Medicine, my main task has been to develop and expand the Occupational Health Service, the main purpose of which is to protect and improve the wellbeing of all Post Office staff while at the same time offering guidance and advice to management.

This has proved at times an awesome task but what began life as a somewhat delicate infant has now grown into a healthy child – and is growing still. But naturally growth is not uniform. Some Regions, notably in London and the North West, are much better developed than others and progress can be most properly described as patchy. One of the main reasons for this is the differing degree of enthusiasm shown by both managers and the unions alike.

Like every other facet of Post Office operation the OHS is susceptible to the economic climate of the times and the early days were somewhat hampered by financial cuts. Currently, however, there is a policy of modest expansion and Regions and Boards are encouraged to invest as much into the service as they can.

Over the past few years I have visited all the Regions several times and although I would not pretend to know in detail what is going on I like to think I have a fair overall picture. I am certainly aware that each Business and Region is an entity in itself and often has its own distinctive set of problems.

Away from administering the OHS there is much else to keep me busy. I am, in fact, 'doctor' to all CHQ staff and I have regular consultations with 'patients', on matters ranging from the reasons for prolonged or frequent sick absences to problems such as possible threats to health caused, perhaps, by a particular working environment. I also advise the trustees of the pension fund on all medical problems and make annual reports to the Board on the state of health of Post Office employees.

I receive, too, my fair share of peculiar letters including an annual communication from one writer extolling the virtues of eating uncooked vegetables. Considerable time is also spent, in adjudicating on matters which fail to be resolved at local level and there have been occasions when dealing with a particular case has eventually

It's our business

led to a change in the rules. In fact, a decision made some time ago on the suitability of a one-eyed man to work as a postman/cyclist became the subject of a Parliamentary question!

As I said at the beginning, there is never a dull moment and no two days are the same as a glance through my letters file will testify. The sheer volume of correspondence alone is remarkable and covers the whole range of Post Office activities; literally, all human life is there.

But what of the future? As I have already suggested, there is still plenty of scope to develop the OHS not only by the recruitment of more nursing staff but also in convincing management and staff alike of its value. Much has already been achieved and it is vital that we continue to build upon what we have already established in the past few years.

Dr Peter Taylor (centre) begins the week with a regular Monday briefing session. Here he discusses an OHS problem with Dr Peter Gilbert, Telecommunications Principal Medical Officer (right) and Dr Michael McDonald, Principal Medical Officer (Posts).

Dr Taylor and Chief Nursing Officer Mrs Shirley MacNay hold a consultation with a Post Office patient.

Communicating without speech

A J Bott

ONE OF THE more exciting areas of telecommunications progress in recent years has been the spectacular advance achieved in the development of non-speech services like Datel, Facsimile and Prestel for use in both business and the home. The increased cost of labour, the advent of the microprocessor and the application of modern technology generally have all contributed to this trend and led to a situation which is having an increasingly marked effect on networks throughout the world.

Indeed, recognising the widespread growth and activity in this field, the Comité Consultatif International Télégraphique et Téléphonique (CCITT) organised a symposium earlier this year in Geneva on new telecommunications services. It was divided into four sessions dealing with Teletex, a text communication service using terminals with office typewriter facilities to remote stations via public networks, Videotex, an interactive data retrieval service operating through public networks and capable of displaying pages of text or pictorial material on the screens of suitably equipped television receivers, Document Facsimile and Service Integration.

Prestel (above) and facsimile (below) are two non-speech services which have been developed recently by the Post Office.

Left: One of the most familiar non-speech services is telex which uses the public switched telegraph network.

It was in fact in 1976 that CCITT began to study the technical and service requirements for a new text communication service which would offer more sophisticated features than the existing telex service. The name chosen for this service was Teletex and a number of draft recommendations, which are in course of preparation, are expected to be ratified at the 1980 Plenary Assembly.

Teletex will provide a service primarily for the business community using terminals strongly resembling present day editing typewriters or, as they are sometimes called 'word processors'. The basic features will enable text to be prepared, edited and stored ready for transmission. The character repertoire will include upper and lower case founts and enable correspondence to be sent and received in any Latin-based language. Call set-up and clearing will be automatic and a high transmission rate (2400 bit/s) will be used to reduce line occupancy. Interworking with telex and facsimile services is under study.

A number of speakers at the symposium reported plans well advanced in their countries for trials which are expected to lead, in due course, to the introduction of a full teletex service. It is left to individual administrations to decide which network they will use to provide the service and, while some will initially use the telephone network, most see the service eventually being carried by the evolving data networks or, ultimately, by a digital network common to both speech and non-speech services.

In May last year, CCITT began studies directed towards the development of recommendations for a 'public network-based interactive information retrieval system' previously known as viewdata in the UK. Because this description is long-winded it was agreed that the term 'Videotex' should be used for the time being within CCITT until a permanent title is adopted. Videotex studies have been accorded a high priority and a number of meetings have taken place with the object of ratifying both service and technical recommendations at the 1980 Plenary Assembly.

Earlier this year, shortly before the symposium, Prestel, the Post Office's version of videotex, had become the world's first videotex service to begin commercial operation. Two papers were presented by Post Office speakers and one by an information supplier dealing with various aspects of Prestel. A live demonstration of a terminal working to a Prestel computer in the UK attracted much interest.

The emphasis in the UK in developing Prestel has been to keep the costs to a minimum by making maximum use of television standards which allows domestic users to participate using terminals little more expensive than ordinary television sets and able to function as such in addition to their Prestel role.

The other videotex papers presented showed widespread activity in conducting tests of systems, not only based on Prestel, but also the development of systems having more extensive facilities and higher definition displays than the present Prestel service. It is not yet clear how customer reaction will set the balance between demand for inexpensive systems and ones giving more sophisticated facilities which are now technically feasible but at higher cost.

Facsimile transmission was demonstrated by a Scottish inventor named Alexander Bain as long ago as 1842. Despite its apparent attractiveness, its commercial exploitation has been slow, except in some specialised applications, mainly because of competition from alphabetic telegraphy and because of technical limitations. Some CCITT technical recommendations already exist for document facsimile equipment and further recommendations, are in course of preparation relating to both customer and bureau type services.

At the symposium some speakers reported customer services already established or planned using document facsimile machines capable of transmitting an A4 sized document in three minutes. The British Post Office is about to introduce a service of this type under the name of Fonofax. Speakers looked forward to future facsimile services based on digital transmission and the use of digital networks to give reduced transmission time. In Japan, planning for a new facsimile communication network is well advanced and the extensive use of Kanji characters (Chinese ideographs) gives an added incentive.

Bureau-type document facsimile services have been set up between some countries and further services are planned. In this type of service, the facsimile equipment is installed in offices of the operating agency and copy is usually transported by post or messenger between the customer's premises and the local facsimile office.

The fourth session of the symposium illustrated the way in which the divisions between post and telecommunications and between telecommunication services themselves are being broken down. Bureau-type facsimile services are already running into policy troubles in countries where the postal and telecommunication services are run by separate authorities because both regard the running of such bureaux as falling within their own traditional sphere of operation.

The provision of non-speech communication equipment for operation by customers from their own premises

Continued on page 33

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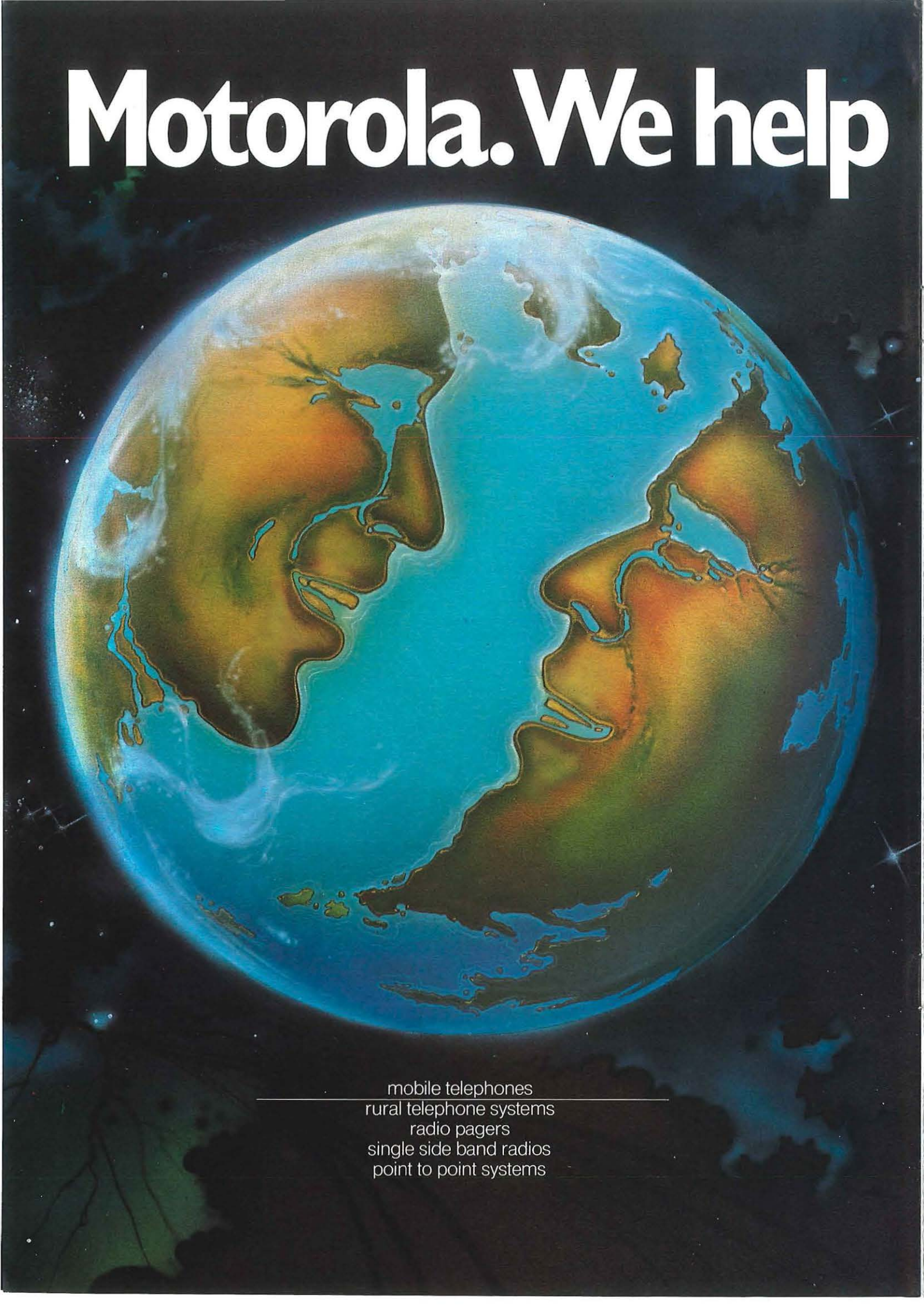

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The Visual Display Unit makes the most of the Memory in message preparation. Messages can be prepared without interruption while other messages are being received or sent.

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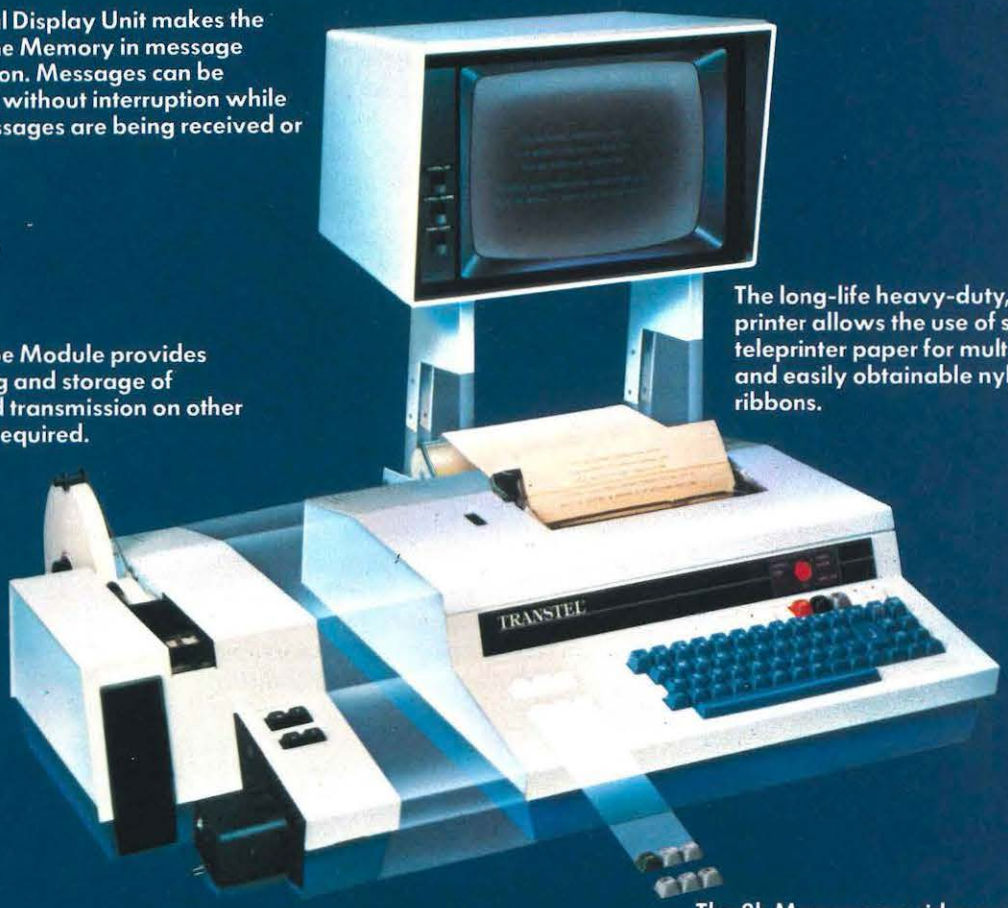

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Specifically designed and built for Telex or Private Circuit operations, the B315 series provides unmatched capability, versatility, reliability and ease of operation. Microprocessor electronics eliminate complex and tedious procedures, and keyboards look, feel and operate like those on electric typewriters. In fact Transtel teleprinters are quieter than electric typewriters and their slim styling and matt steel finish fit any office environment.

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Continued from page 29

is nearer to the traditional role of a telecommunications authority but, nevertheless, postal authorities can be expected to react vigorously when they see a significant volume of their business becoming diverted to electronic mail systems not under their own control.

The development of new non-speech services is certain to influence existing telecommunication services. The recent rapid growth of the use of facsimile in Japan, for instance, has already reduced the demand for telex in that country. Telex will also be vulnerable to competition from teletex, and in some applications, facsimile will be vulnerable to competition from teletex and videotex.

Recognising that existing and proposed new services often overlap in meeting users' requirements, much effort is being devoted to drawing up standards which give the maximum practicable compatibility between services. Particular examples of this are interworking between teletex and telex terminals and common display standards for videotex and teletex so that a single terminal can be used for either service. The latter is already possible with Prestel terminals. And there is the use of compatible control protocols for teletex and facsimile. This would allow graphic material, such as a signature, to be included in a teletex message.

At present it is difficult to forecast how non-speech services will develop in decades to come, but it seems likely that users will have multiple-use terminals which can present information and messages either as documents or on a display screen. A variety of input arrangements are likely to be available.

A common feature of evolving services is the tendency to use digital techniques. Post Office plans for handling communications in digital form are well advanced with development of new digital transmission systems and the System X switching equipment. It seems reasonable, therefore, to look forward with confidence to the time when both non-speech and digital speech services are carried by an integrated communications network.

Mr A. J. Bott is a Head of Section in the Telegraphs and Data Systems Division of Telecommunications Development Department responsible for telegraph and facsimile machines and telegraph transmission.

A brief description of various terms associated with non-speech services.

Antiope	French version of teletext
Autofax	See Fonofax SF. Autofax was the name used during research and development.
Bildschirmtext	German version of videotex.
Bildschirmzertung	German version of teletext.
Bureaufax	Operational provisions for the public facsimile service between Administrations' offices. CCITT title.
Captain	Character and Pattern Telephone Access Information Network System. Japanese version of videotex.
Ceefax	Proprietary name for the BBC teletext service.
Datafax	Public facsimile service between subscribers' stations via a data network. CCITT title.
Datel	General title for data transmission facilities offered by the Post Office.
Facsimile	Common abbreviation for Facsimile Telegraphy. System enabling fixed images to be reproduced in permanent form at a distance using a scanning technique.
Fonofax	Proprietary name for public facsimile service operated by the Post Office.
Fonofax SF	Fonofax Store and Forward. Proposed public facsimile service using high-speed scanning, storage and auto-calling equipment on the switched telephone network.
Intelpost	Experimental electronic message system being set up by US Postal Service with several countries including UK. Will use high-speed digital facsimile terminals.
Interactive Teletext	A term used to mean videotex.
Oracle	Proprietary name for the IBA teletext service.
Postfax	Proprietary name for the public document facsimile transmission service provided by the Post Office at selected main Post Offices. Service withdrawn 30 September 1976.
Prestel	Proprietary name for the public videotex service operated by the Post Office.
Télécopie	French term meaning Document Facsimile Telegraphy.
Telefax	Public facsimile service between subscribers' stations via the public switched telephone network (or the international Datel network as appropriate) CCITT title.
	French PTT's equivalent of Post Office Fonofax.
	ITT proprietary name associated with their facsimile equipment marketed in the UK.
Telesoftware	Software transmitted by line or broadcast means, to specially adapted television receivers embodying an additional microprocessor. When received, interactive routines can be undertaken using the keypad without further external transmissions.
Teletel (Titan)	French version of videotex. Formerly known as Titan.
Teletex	A text communication service using terminals having office typewriter facilities, including editing functions and transmission capability to remote stations via public networks. Currently the subject of substantial standardisation activity, particularly in CCITT and CEPT.
Teletext (Broadcast Teletext)	A digital data broadcasting service associated with a television signal and intended to display pages of text or elementary pictorial material on the screens of suitably-equipped television receivers. This system employs cyclic repetition of pages.
Telex	A world-wide page-printing teleprinter service, mainly used by business and commerce, which uses the public switched telegraph network.
Telidon	Canadian Department of Communications' experimental videotex system.
Telset	Finnish version of videotex.
Videotex	A title used, but not formally approved, by CCITT, for an interactive data retrieval service operating through public networks and capable of displaying pages of text or pictorial material on the screens of suitably-equipped television receivers.
Viewdata	A generic title used by Post Office and others prior to introduction of the term Videotex.
Vista	Bell-Canada version of Videotex.

Quality of telephone service

Despite the worst winter weather for a decade and severe industrial disruption in the Post Office, there were some improvements in the telephone service during 1978/79 — a year which saw 90 per cent of UK customers able to dial 400 million telephones in 85 countries around the world. The biggest improvement is in the national figures for the number of faults reported by customers on their telephones. At 0.64 faults per instrument the figure was 0.02 down over the 1977/78 period maintaining a steady improvement in reliability. Customers also enjoyed speedier service from telephone operators.

Nothing however could offset the effect of Arctic conditions in the early part of this year or industrial action continuing through the spring and summer. As a result, the number of local, dialled and international calls which failed because of faults or shortages in Post Office equipment increased. And the number of faults on customers' telephones which were repaired by the Post Office's "end of next working day" target, were also down.

The table below represents national average figures.

	1978/79	1977/78	1976/77
Local automatic telephone service			
Calls that fail due to the Post Office includes those caused by equipment faults or insufficient plant.	1.6	1.5	1.5
Calls not connected satisfactorily because they were abandoned prematurely or the number dialled was incomplete, incorrect or unavailable.	6.9	7.1	7.1
Calls that obtain 'engaged' or 'no reply' These calls have passed through the PO network satisfactorily but fail because the called number is engaged or there is no reply.	28.4	27.3	26.6
Calls connected successfully	63.1	64.1	64.8
STD automatic telephone service			
Calls that fail due to the Post Office includes those caused by equipment faults or insufficient plant.	3.5	3.3	3.3
Calls not connected satisfactorily because they were abandoned prematurely or the number dialled was incomplete, incorrect or unavailable.	8.3	8.7	8.9
Calls that obtain 'engaged' or 'no reply' These calls have passed through the PO network satisfactorily but fail because the called number is engaged or there is no reply.	24.4	23.3	22.5
Calls connected successfully	63.8	64.7	65.3
Repair service			
Yearly fault reports per telephone	*0.64	*0.66	*0.67
Percentage fault reports cleared by end of the next working day	49.9	68.4	74.4
Inland telephone operator service			
Percentage of calls answered within 15 seconds	84.9	84.3	87.1
International automatic telephone service (IDD)			
Calls that fail in the international automatic exchanges due to faults or congestion within the exchanges.	4.4	4.2	5.4
Calls not connected due to other causes including customer dialling errors, faults on the international cable or satellite links or difficulty in the distant country. More than 40 per cent of international calls could not be connected because the distant telephone or equipment was engaged, or there was no reply.	58.0	57.6	57.6
Calls connected successfully	37.6	38.2	37.0
International telephone operator services			
Percentage of calls answered within 15 seconds	52	58	63

* Not represented in percentages

MISCELLANY

Telconsult abroad

The Post Office has created a new agency – known as BPO Telconsult – to help other countries modernise their telecommunications systems. The new service will have at its fingertips, the huge resources of the Telecommunications Business, the third largest in the world.

Announced at the TELECOM 79 exhibition in Geneva during September, BPO Telconsult will help other nations to bring their own telecommunications systems into line with that of Britain and other leading countries. The new agency will help the Post Office improve and expand its expertise in dealing with the telecommunications problems of other administrations and will be able to offer impartial advice on network design, equipment standards and the administration needed to run efficient, profitable telecommunications services.

Exchange on trial

Britain's first all-electronic digital local telephone exchange – of a type that could radically improve telephone facilities for small rural communities – is now formally in service on a trial basis near Aberdeen.

It incorporates a microprocessor-controlled system which, if successful, will not only bring improved telephone service but also could later offer new facilities to isolated hamlets. These facilities will be available to town dwellers when System X exchanges – the electronic system which will revolutionise the nation's phone service in the 1980s and beyond – are installed in towns and cities.

Exchanges which can provide advanced facilities such as automatic alarm calls, short code dialling and automatic diversion of calls to an alternative number are most cost effective in sizes suitable for larger communities. On small rural exchanges with just a couple of hundred customers, the cost of providing these facilities could be uneconomical but the tiny prototype digital exchange in Scotland could prove otherwise.

The exchange system now being tried out in Scotland is derived from an advanced design of call-connect system (PABX) which the British telecommunications industry will be producing in large quantities for the Post Office to offer to business customers. Known as the customer digital switching system 1. (CDSS1) and marketed as Monarch 120, it was developed jointly by the Post Office and industry.

A new cable linking the UK with Spain was brought ashore by engineers from the Post Office cable ship Monarch on a lonely beach at Porthcurno, Cornwall in October. Able to carry 400 simultaneous telephone conversations, the new cable is by far the largest capacity undersea link to span the 423 nautical miles to Rodiles in north west Spain. It will also be used to relay messages to other European countries and will be interconnected with TAT7 – a new transatlantic cable due to come ashore on the same beach – early next year.

Whitby Radio opens

Whitby Radio, an unmanned station located between Cullercoats and Humber medium-range coast stations, has become the second short-range VHF station to open in nine months and is part of a five-year Post Office plan to improve maritime communications services.

The new station covers an area from Tees to Flamborough Head and is one of 13 unmanned stations which provide continuous radiotelephone service to vessels of all sizes and nationalities up to 50 miles from shore.

Like all the other coastal stations, Whitby broadcasts routine weather reports, navigational warnings and listens out for distress calls or messages from vessels needing medical aid.

Two more short-range stations are planned for 1979 – at Skye and Butt of Lewis. Both these will be controlled from Oban radio.

Chataway in the chair

The first chairman of British Telecommunications Systems Ltd, the company formed jointly by the Post Office, GEC, Plessey and STC to promote System X exports, has been appointed. He is Mr Christopher Chataway, a former Minister of Post and Telecommunications and a distinguished politician who held the ministerial portfolio for industrial de-

velopment from 1972 to 1974.

The Post Office has already placed contracts with its three partners for the introduction of eight System X exchanges into the UK network during 1981/82. More orders are expected to follow.

Contracts

Marconi Communications Systems Ltd – For £4 million for 30-channel pulse code modulation equipment. The company has also won a contract for the development of a hypergroup codec. Equipment provided will enable 840 or 900 telephone channels assembled in an FDM hypergroup to be routed over a digital line and microwave radio relay systems.

Plessey Telecommunications Ltd – For £1.5 million for 20 FDM (frequency division multiplex) and digital transmission stations and four 12 MHz coaxial line systems which will be used in the Midlands, and in the Manchester area.

Plessey Controls Ltd – For £5 million to supply automatic letter-sorting equipment. The contract will mean the completion of a nationwide network of automatic sorting offices, and will enable full advantage to be taken of the postcode.

Precision Air Control Ltd – To install air handling plant for exchanges in Bromley, Kent and Langley in Buckinghamshire.

Redifon Telecommunications Ltd – For £700,000 to supply racking for paging equipment. The order follows an earlier contract this year for 100 watt paging transmitters.

Trend Communications Ltd – For 80 all-British Trend 800 electronic send and receive teleprinters. These will be used for the development of ship-to-shore communications services, based at Portishead Radio.

GEC Telecommunications Ltd and Telephone Cables Ltd – For £2.6 million for optical fibre systems operating at 8 Mbit/s and 140 Mbit/s. The contracts provide for a total route length of 111 miles and the cables will contain 896 miles of fibre. GEC systems will be installed between London and Reading at 140 Mbit/s; Reading and Oxford at 34 Mbit/s; Oxford and Banbury at 8 Mbit/s. An additional 8 Mbit/s system will link Cambridge and Arrington.

Labgear Ltd – £150,000 for manufacturing a telephone line tester, designated TRT 302.

New Board member

Mr C. E. Beauchamp has been appointed a member of the Post Office Board with special responsibility for finance. He succeeds Mr F. H. Waterhouse, who has returned to the private sector. Mr Beauchamp joined the Post Office in 1939 and before his appointment was deputy to the Board Member for Finance.

Prestel international

Experiments which may lead to an international viewdata service have been announced by the Post Office. Commenting on a new market trial, due to start at the end of the year, Post Office Telecommunications Managing Director Peter Benton said that the Post Office was not yet certain that a full Prestel international service would be a viable proposition, but that there had been sufficient interest in launching such a trial.

The trial will be open to selected users in the UK and up to six more countries – Australia, the Federal German Republic, the Netherlands, Sweden, Switzerland and the United States – and will provide a wide variety of business information.

When the trial begins, customers will use a new £2 million computer network opened by the Post Office in September. This new network can handle thousands of new customers each month and will make Prestel even more readily available to the 3½ million customers in London whose phone numbers begin with 01.

Informality in the LTR

London Telecommunications Region are again holding a series of monthly informal meetings during the winter.

The 1979/80 season includes talks about the Post Office Staff Superannuation Fund (13 December), and the work of the Meteorological Office (22 January). Mr Ken Leeson, formerly deputy director of LTR and currently director of the Eastern Telecommunications Board will be the speaker at a meeting on 20 February, and there is to be a highly-topical discussion on Local Administration Centres for System X on 20 March.

Fingertip control

With Malawi and Guyana now available on direct dialling from the UK, there are 87 countries which can be dialled without the help of the operator. The East African Republic of Malawi has some 22,000 telephones, while Guyana, the fourth South American country to become available on IDD, has 30,000 telephones.

Ring for service

Golf – Enthusiasts wanting information about the Suntory World Match Play Tournament at Wentworth during October were able to dial a new Post Office service, which provided details of the competition and gave up-to-the-minute scores and match positions. More than 50 centres throughout the country transmitted the service.

Pop – Ten new releases selected from a list of potential chart hits can now be heard each week by London customers who dial 154, the number used during the summer to provide cricket information. The Record Releases service supplements Dial-a-Disc which provides 'Top Twenty' music throughout the year on 160 for London telephone users. Last year the Record Releases number received about 3½ million calls during the eight months it was available.

Motorcycling – Information on the Manx grand prix held in September was available to customers served by 49 centres throughout Britain. Fans heard Denis Parkinson, motorcycling commentator and former competitor, previewing each race and giving useful information about the riders and their machines.

More autotelex

More countries are now within reach of Britain's 80,000 autotelex users. The introduction of direct dialling to Cameroun, Addis Ababa (Ethiopia), Liberia, Sierra Leone, Peking (People's Republic of China), Brunei, Burma and the Maldives Republic brings to 132 the number of countries with autotelex links with the UK.

About 98 per cent of the 68 million international telex calls from the UK last year were made without operator help.

Further talks

The Postal and Telecommunications Society have also issued details of their lecture programme for the 1979/80 season. Subjects include telegram services, satellite communications, management in the London Telecommunications Region, 'mail and money by wire' and System X.

Further information is available from Tony Allen on 01-606 5233.

This unique vehicle, a specially-converted Land Rover, will be on standby this winter to carry engineers and equipment to isolated exchanges in the remote areas around Inverness. The metal track allows the Land Rover to negotiate 45 degree gradients and 30 degree side banking. The vehicle is based at the Post Office's motor transport workshop in Inverness.

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Telecommunications and Society

Mr Peter Benton, Managing Director, Post Office Telecommunications, gave the following address to delegates attending the first session of the World Telecommunications Forum at the Palais Des Expositions in Geneva where the Telecom 79 exhibition was held.

It is a very great honour and pleasure for me to have this opportunity of reviewing the inter-relationship of Telecommunications and Society before such an audience. Having come to the telecommunications industry as recently as two years ago, I am perhaps even more aware of the profound impact that our industry and our technology will have on society than those who have been participating in the process of change from the inside. We certainly are at a point when revolutionary change in our significance to society is taking place, and it does seem to me very helpful to stand back from time to time from the hurly-burly of the new technology and the explosive growth, in order to review

where we have come from, where we are going to and what we are trying to achieve.

It is peculiarly appropriate to review this together on an occasion like this, because in our extraordinary industry we are all, by the essential nature of telecommunications, linked together. None of us can find all our own solutions in our own way; we must reach our solutions in co-operation with each other, based on a common ideal of relevance to our own societies and the world society that telecommunications makes more real each day.
The International Telecommunications Union has a crucial role to play, and the Forum and Exhibition that is being launched now will, I am certain, mark the start of a new epoch in telecommunications.

The 19th century, that great cradle of technology, fostered by the industrial revolution and making it possible, saw our industry developing alongside powerful developments in the means of physical transportation.
Over the last 100 years we have seen first one, and then another, technology of communications make the running; railways, shipping, motor transport and most recently aviation. Now with clear limits to the supply of energy from fossil fuels, it is the turn of telecommunications to pull ahead.
And I must say as I look to the distant future, that I doubt whether our advance will be limited by decades;
I expect that our contribution to society will continue to expand and develop as long as human society exists as we know it today.

But in our experience, it is not just the opportunity to save energy that makes new telecommunications facilities attractive to our society; for the businessman for example, the opportunity to hold discussions face to face through Confravision is welcomed perhaps more for its saving in time, and avoidance of the personal stress of frequent travel.
For the householder, farmer and businessman, our new Prestel service already launched in London and spreading to a dozen major cities in 1980, offers the opportunity to get information, and to complete transactions including the transfer of money direct from the office or home.

Well, I am sure that none of you, who shares with me the responsibility of managing a telecommunications administration in a modern economy, has any doubts about the scope and scale of our impact on society today.
It seems to me that the telephone, which within living memory was seen by most as an additional asset for the privileged, whose facilities were welcomed with amazement and gratitude, is now seen as the right of every man.
Now in our society, the ability to telecommunicate effortlessly – and it sometimes seems with absolute reliability – is regarded as one of the basic human rights like free speech.

This implies for the administration, that we must not just measure the performance of our plant in an inward looking way, monitoring the performance of engineering plant from an engineer's point of view.
We in Britain are now well aware that we must look at our service from the customer's point of view; we must in our measurement methods seek to reproduce as closely as possible the customer's experience in making calls, and recognise the customer's infuriation with the small percentage but still large number of really aberrant performances.

We have developed, in conjunction with British industry, our computer-based Measurement Analysis Centres.
These continually in a programmed way dial calls through the network to test numbers in local exchanges; we reproduce in a systematic way the experience of our own customers.
We are also working not just, as so often in the past, to improve the average performance, but rather concentrating our efforts on clearing the most protracted difficulties.

But not only is telecommunications making immense strides in relevance to society as it stands today, but we are also benefiting, as the industrial revolution matures, from the strong trend in all advanced societies from the manufacturing phase into a new era in which the provision of service in an almost unimaginable variety of forms increasingly gives the impetus to sustain economic growth.

Certainly in Britain, we have for decades been foremost in providing the world with financial, insurance and information services; recent forecasts indicate that employment in the service sector in Britain will rise from 55 per cent of the working population now to 65 per cent or more by 1990.
We are indeed entering the age of the information society.

As anyone involved in this plethora would observe, much information rapidly loses its value with delay, and it is the ability to select precisely the information that one requires that makes today's abundance a blessing rather than a curse.
We can all, I imagine, remember as little as 10 to 15 years ago, the pride with which our computer managers produced weekly, monthly, quarterly and annually, large piles of printouts; for the sales manager, perhaps figures on sales by product, by units and value, by area current and cumulative.

In those days, it seemed that the only link between the individual and the computer was the printing press.
Now of course telecommunications and its kindred technology

of computing provide the essential solutions; with our data systems, and with new developments like our Post Office Prestel, we make it possible for individuals in the new information society to reach precisely the information they need and to receive it with its latest possible corrections. With Prestel, we have, I believe, made a very significant advance, in providing a key to this abundance of modern information to every householder with a telephone.

Our London service already provides more than 130,000 pages of information, with access made simple by printed directories, or a logical search route provided within the Prestel service itself. Also, with our new packet switching service, operating within Britain and now to the United States, we have used a new technology to reduce the cost of accessing a variety of databases in our respective countries.

Of course, our very success has extended our relevance to our own national society still further. The scale of our operations is immense; scale not just in the funds required for the investment to sustain and enhance our facilities, but also in the jobs we provide. In Britain, as in many advanced nations, telecommunications is one of the largest employers; our decisions affect many hundreds of thousands of jobs, and the security of the families that depend upon those jobs. In the remarkable revolution of the technology of our new network systems, with dramatic improvements in efficiency, and reduction in the labour content of manufacture, we must give careful thought indeed to the consequences of our actions.

In my view however, we have no alternative but to ride this thoroughbred technology of ours as fast as we know how. History has shown that as we widen the scope, enhance the facilities, and reduce the cost of our services, growth follows with the inevitability of a natural law. We only have to look at the extraordinary expansion of international communications as satellites have widened the scope, international direct dialling has speeded the connections and multiplexing techniques have reduced the cost. In Britain international traffic is growing at 25 per cent a year, doubling every 40 months.

In any review of the significance of our industry to modern society, it is appropriate to consider the complex question of how telecommunications should be managed. There is the need on one hand to make good and efficient use of the enormous sums involved in investment and current expenditure, and on the other to ensure that modern societies do get the equipment, facilities and quality of service on which national prosperity now depends. There are many different solutions to this issue around the world, but virtually all are based on the imperative requirement that no one should be excluded from the benefits of telecommunications; the provision of basic facilities must be seen as a public service, with consideration of profit in the individual case subordinated to the basic obligation to provide a universal service to the whole of society.

But too close a relationship with Government can lead to interruption in the smooth programmes for developing telecommunications that are so essential in enterprises of such massive scale; the very size of our cash flow tempts Governments to use our industry almost as an economic regulator, and we well know how dangerous that can be when it leads to interruptions in carefully laid plans for long-term improvements. My view, perhaps predictably, is that we have in Britain found a solution that has many advantages while avoiding some of the pitfalls. As a separately-established public corporation, our obligation to serve the public is clear and unequivocal; on the other hand our separation 10 years ago from central Government has helped to insulate us for most of the time from the major changes involved in managing an economy in this post-Keynesian age.

However, I have no doubt at all that in the new era in which telecommunications, computing and office equipment come closer together, there is a need for a variety of suppliers if the various needs of our customers are to be met. The real issue facing developed societies is how to ensure that the basic telecommunications facilities are provided in a way that cares for the interest of society as a whole, while encouraging a free and vigorous flow of the benefits of new technology into the market place.

Regulation has its clear dangers unless applied with the greatest prudence; the rules can so easily distort the activities of those they seek to govern. But in one respect I believe there is no question at all; the need to ensure that customers can communicate freely and with confidence in this giant world network, makes our efforts at achieving world technical standards of the greatest importance.

Perhaps the development of facsimile illustrates most clearly how the absence of agreed standards can result in an electronic Babel, blocking market growth. Now that some standards have been agreed, national and international services are facilitated, and there is every sign that growth will be rapid. In Europe now, under the aegis of CEPT, we are making useful progress towards defining the characteristics of a new multi-purpose integrated digital

network that will bring benefits to all our countries in the not too distant future.

The choice of innovation in our industry is now so great that prudent selection of the new technologies and wise implementation into our internal networks have become perhaps the most challenging tasks for our administrations. We must avoid the temptation to be merely fashionable in placing expensive bits of modern hardware in piecemeal fashion within our networks; our concern must be to see that the pattern of implementation of the new equipment in switching and transmission fits the needs of society.

Our problem has been to find an elegant – in the mathematical sense – solution to bringing the full benefits of the new technologies swiftly and economically to wherever in our society they can best be used.

We are planning to implement over the next few years a separate network – integrated digital network for voice and data based on 64 kbit/s channels – overlaying but yet linked to the vast analogue system that serves our customers today. By this approach, we can swiftly bring to customers in any of our major cities the benefits deriving from calls made in the digital mode throughout, assisted by end-to-end fast signalling.

In planning our network, we are also well aware that our technology will develop over the years in ways that we have perhaps not yet even contemplated. And so our concern in developing our switching equipment has been to provide, through modular design, for the greatest degree of evolutionary capability. We intend to introduce new services, facilities and standards, and also make it possible to take advantage of new technical devices and new generations of technology as they become available.

One remarkable characteristic of telecommunications that must encourage all of us, is the happy way in which success breeds success. Advances in the capability to multiplex numerous circuits or messages through facilities that might earlier have carried only a few, gives our industry a remarkably low marginal cost of carrying additional traffic. So the faster traffic grows, the lower become our unit costs, thus providing an additional stimulus to further growth. But this can of course, as has already been pointed out, lead to ever-increasing prosperity in the nations with heavy international traffic, while the developing nations lag behind.

In telecommunications, however, we are all governed by the essential fact that it takes at least two to telecommunicate. We in Britain cannot introduce for our customers a new facility to another nation without the closest co-operation of our telecommunications colleagues abroad.

None of us can prosper without promoting the prosperity of our corresponding administrations.

In the event, I believe we have co-operated quite admirably in the complex task of planning integrated satellite and submarine cable networks that balance the requirements for diversity and restoration facilities on the one hand, against the overall economics of the network on the other.

And satellites have made available for the first time high-quality telephone, data and television connections to many countries remote from sea boards; they too have now joined in the sequence of growth in telecommunications traffic, and consequent reduction in cost that will contribute to the prosperity of their nations as effectively as this benevolent cycle has stimulated economic growth in the West.

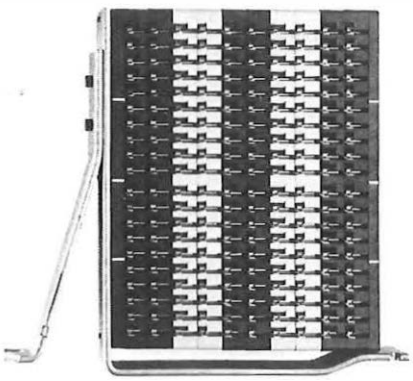
Already, the developing nations in our world telecommunications family are beginning to see that indeed success does breed success; and perhaps by offering their societies the ability to combine the efforts of individuals in co-operative enterprises, without packing people together into hard-pressed cities, they will help to avoid the worst urban horrors that the industrial revolution has brought to so many Western nations.

United today, under the aegis of the International Telecommunication Union, one of the oldest established bodies for international co-operation, we are dedicated to the concept of mutual aid in building the world telecommunications network. We in Britain confirm our support, and the commitment of our resources in technology and experience to aid other nations in providing the benefits of modern telecommunications to their own societies.

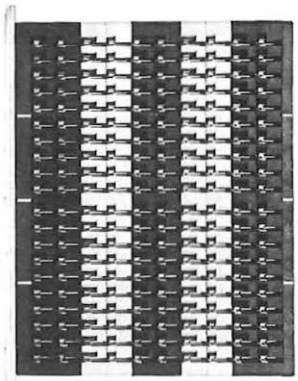
We have today several hundred engineers working abroad in Africa, in the Middle East, in Asia, in South America and the Caribbean. We are consolidating and strengthening our overseas liaison and consultancy facilities; with an engineering force of over 100,000 men, backed by planners, research and development engineers, we have enormous resources on which to draw.

By pursuing together our joint objective to develop telecommunications throughout the world, we shall promote economic prosperity, and help to remove the misunderstandings that lie at the root of so much international friction. We have a crucial role to play in ensuring that world society is able to achieve a prosperous peace.

M.D.F termination



JACK TEST
37/1B



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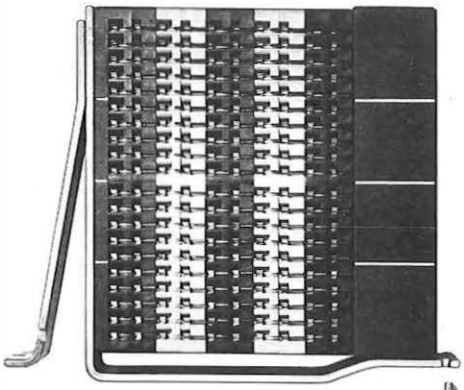
38/1B



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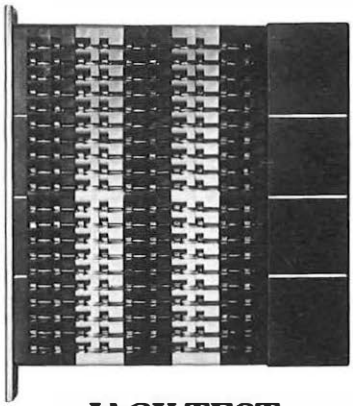
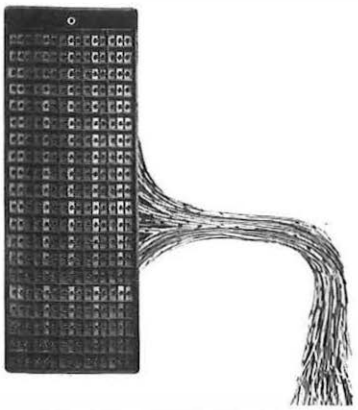


JACK TEST
40/1B



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Jacks Test Nos. 37/38 provide 100 pair termination with test access for the lineside and exchangeside of Main Distribution Frames. Jack Test No. 41A is designed for mounting directly on British Post Office PBX frames.

This range supersedes Fuse Mounting No. 10064 and Jack Test No. 33 and fixings are compatible.

Cable connection is made to wire-wrap tags and jumper wire connection to solder tags. The cable and jumper tags are aligned in planes separated to permit adequate access for wire wrapping and soldering operations.

Jacks Test Nos. 37/38 enable a 3200mm (10ft 6in) rack type MDF to accommodate up to 1000 pairs on each side of the vertical. Mounting brackets are suitable for immediate bolting to pre-rack and rack type MDFs as well as PBX frames.

Jacks Test Nos. 39/40/42A

100 pair termination units, pre-wired to Protector Mounting No. 4A with socket access for 3 electrode gas discharge tubes (Protectors No. 14A), protect switching equipment from potentially damaging high voltage surges on subscribers' and junction lines.

Protector Mounting No. 4A

Available separately, this unit is for retrospective wiring to Jacks Test Nos. 37/38/41A to convert them to Jacks Test Nos. 39/40/42A respectively.

Birkbys Plastics

a member of the **PLESSEY GROUP**

Birkbys Plastics Limited, PO Box 2, Liversedge, West Yorkshire
United Kingdom WF15 6QA.
Telephone: Heckmondwike (0924) 403721. Telex: 55332.

NAME: _____

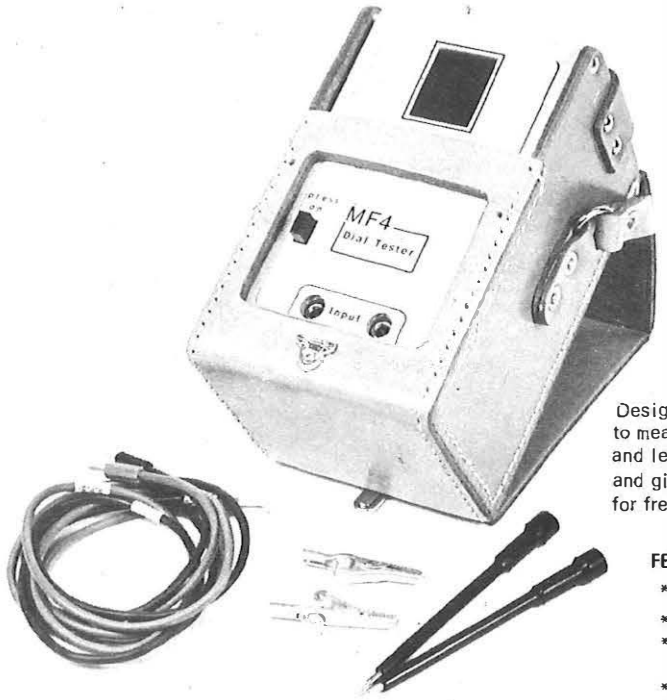
TITLE: _____

ADDRESS: _____

_____

Please send me further details of the Jack Test range.

Birkbys Plastics Limited, PO Box 2, Liversedge
West Yorkshire, United Kingdom WF15 6QA. 0150-2-0034



MF4
Key-Dial Tester

from
WALTON ELECTRONICS

Designed as a lightweight, portable, service aid for engineers to measure simultaneously Dual Tone Multi-Frequencies (DTMF) and levels at the subscribers installation or at the exchange, and give a clear pass/fail indication within specification limits for frequency and level.

FEATURES:-

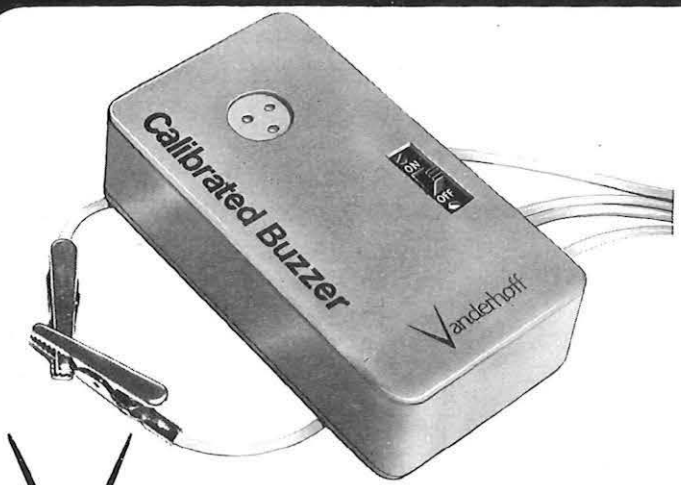
* Frequency detect bandwidth: ± 2% of f_0
* Wide dynamic range –25 dBm to + 4 dBm
* Typically 2000 complete 12 character measurements using standard PP3 9 Volt battery
* Supplied complete and ready to use with all accessories
* Also available to order as a rack mounting, line powered unit for main exchange use.
* Distributed world-wide through approved agents

For further information please contact:–

WE WALTON ELECTRONICS LTD.
PEMBROKE HOUSE, 11 NORTHLANDS PAVEMENT, PITSEA, BASILDON, ESSEX. SS13 3DX
Telephone:– Basildon 551715 Telex:– 995163

your continuity consultant!

the Vanderhoff calibrated buzzer



The Vanderhoff Buzzer has a major advantage over other types in that the resistance which the buzzer recognises as acceptable continuity can be pre-set by a simple screwdriver adjustment. The buzzer tone level being constant for all acceptable resistances.

Due to the low voltage present at the buzzer probes, it can be used on most electronic circuitry including T.T.L. & C.M.O.S.

Specification
Resistance recognised as continuity is variable from 2-40 ohms.
Open circuit voltage at probes – 1V
Inputs protected against external voltages up to – 50V or 240V AC
Current through probes – 140 μA
Buzz tone – 1000 Hz
Current Consumption – 1 - 2.5 mA
Battery life if used daily – 400 hours
Battery – PP3 9 volts
Size – 2½" x 4½" x 1¼"
Weight – 8½ oz.

Vanderhoff Communications Ltd.

BERMUDA ROAD NUNEATON
WARWICKSHIRE

NUNEATON 61111–5
TELEX: 311563

x

MICROPROCESSOR WORKSHOPS

The microprocessor revolution is well underway. And with that revolution comes a challenge to you, the designer. A challenge to rethink certain design concepts; to comprehend microprocessor software development; to understand microprocessor system integration.

The challenge, in short, is to learn. To learn in order to do your job more productively, and to take advantage of the design opportunities the microprocessor revolution has created.

To help you meet the challenge Tektronix are providing two types of Workshop:

Workshop One
Microprocessor Design Workshop

The emphasis is on software development and system integration. After five days of demanding, stimulating work, you'll be able to complete a software design from flowcharting through debugging; operate the Tektronix Microprocessor Development Lab; and understand and solve the problems involved in integrating software and hardware.

Attendee Profile:

Has limited experience with microprocessors; no previous design projects.

Has not used a disk-based microprocessor development system.

Has some programming experience, but probably not with microprocessor assembler language.

Wants an introduction to the use of a complete microprocessor development system and its role in the design process.

When you've completed the Workshop you'll be a more productive, complete designer, having acquired basic microprocessor software knowledge; basic microprocessor design organization; practice in implementing a microprocessor design; and hours of hands-on experience with the Tektronix Development Lab and the 8080.

Duration: 5 days. Cost: £250.

Workshop Two
Microprocessor Development Lab

This three day advanced Workshop emphasizes the use of the Tektronix 8002A in the design process.

Unlike the five day Workshop, there is little attention given to the basic principles of microprocessor software, programming, and design organization. Rather, Workshop time is devoted to hands-on experience with the Tektronix Development Lab, as attendees learn its operation and its role in hardware debugging, software development, and system integration.

Attendee Profile:

Has designed with one or more microprocessors.

Has used a disk-based microprocessor development system or mini-computer.

Has programmed a microprocessor in assembler language.

Primary interest is in acquiring specific, in-depth knowledge of Tektronix Microprocessor Development Lab and in applying that knowledge to his design tasks.

Duration: 3 days. Cost: £200.

Whether you choose the five or three day Workshop you'll find the emphasis is truly hands-on. We limit the number of delegates to 12 and there are 4 Tektronix 8002A systems available, which constitutes some £60,000 worth of equipment. The 8002A is capable of emulating **TMS 9900, SBP 9900, Motorola 6800, Intel 8080 and 8085, Zilog Z80A, Fairchild F8, Mostek 3870, RCA 1802)** but because of time restraints the popular 8080 is used for all practical instruction and work.

The venue is Harpenden and dates so far are as follows:—

Dec. 10-14, Jan. 21-25, Feb. 18-22, Mar. 17-21,*

April 14-18, May 12-16, June 9-13*.

**Refers to Workshop two.*

If you are interested, why not send for our comprehensive Workshop brochure, it's quite free.

Tektronix

COMMITTED TO EXCELLENCE

Alan E. Hutley, Tektronix UK Ltd., P.O. Box 69, Coldharbour Lane, Harpenden, Herts. AL5 4UP. Telephone: Harpenden 63141.

Name .....

Position .....

Company .....

Address .....

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