Maintenance News

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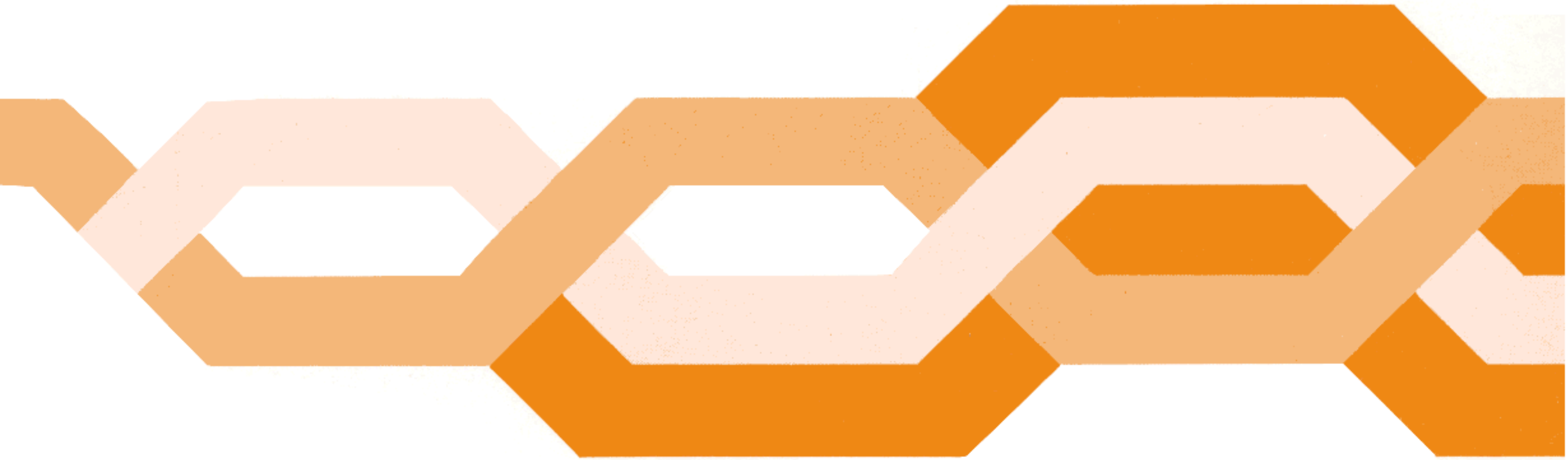

For British Telecom staff only

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Maintenance News

Maintenance News aims to provide a medium for two-way communication between maintenance engineers throughout British Telecom. If you want to write about anything you may have seen in *Maintenance News*, or indeed, about any maintenance topic, send your letter to: The Editor, Maintenance News, Room 301, 203 High Holborn, London WC1V 7BU. Say what you like, but the Editor may tone comments down if he decides to publish. Do please give your full address.

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Contents

Editorial

'In the beginning . . .'
So starts the first chapter of Genesis in the world's best seller. Not wishing to be outdone, John Elliott entitled his article 'Genesis again'. Your humble Editor felt obliged to give the timely composition pride of place as the first article in this issue.

Business accounting – that is what John introduces to us – will become a major feature in determining our profitability and one in which everyone wearing a 'maintenance hat' will play a significant part. As John says: "Let's make sure we don't fail".

A related article by Nick Furley on call logging indicates how seriously we are taking our new business commitments.

–Editor

Genesis again

by **John Elliott** IFC3

Until recently British Telecom's accounting systems had changed little since the days when we were part of the Post Office, despite rapid changes in telephone technology and much more demanding customers. The days of 'You can have any colour you like as long as its black' have gone for ever. Similarly the way British Telecom is organised has changed. Today areas have far more freedom than ever before and are expected to react to competition and to operate just like any other business.

Our old accounting system was a centralised one, and local offices completed lots of forms which were sent to London, where 13 blind nuns buried deep under Gresham Street produced the accounts once a year. We knew what profit the corporation had made overall, but not by area and not by product or service.

Over the last 18 months we have been creating a new accounting system which is very much area-based, and will show how profitable each area is each month. During 1984 we hope to extend the system to show how profitable each of our major products is, and to show also how much we are making on all our trunk routes. The object is not to create an accountant's paradise, but to give local managers the information they will need to beat the competition and make a good profit – and that can't be bad as it will safeguard our jobs and give us satisfied customers.

This all sounds very simple but the work involved in achieving it has been immense. A completely new accounting system has had to be developed and is now being loaded on to a whole host of local computers, so that we can produce results quickly. A new internal billing system had to be created, so as to allow us to move our costs from where they were incurred to those who caused them. For instance, every area uses the central computers and we had to find a way of charging them for that use.

Perhaps most importantly a new call sampling system had to be invented and installed in each area so that we could measure the volume of calls which were made each month. As we only bill our customers once a quarter, we only read their meters once a quarter and this is no good for monthly accounts. Also the meter only tells how many units they have used, it doesn't tell how many calls there were, how long they were, what they cost, or whether they were local, trunk or international calls – the sampling gear does this.

On the product side we have had to find a way of gathering together all the costs which occur when you connect a new customer or do some maintenance. There are the stores which are used and the labour – and here we must rely completely on what you record on the stores-slip or your timesheet (sometimes neither of which is easy to read!).

The linchpin of the new system is the area chief accountant and his or her small band of →

helpers – yes there are two ladies. They are there to aid the British Telecom board and the local managers, and to try to provide some answers to the constant questions – How much profit did we make? Which is the most profitable product? And so on.

These are early days yet. The world may have been created in seven days, but 18 months isn't long for accounting systems. If we succeed, then the areas will be well placed to ensure that Telecom remains the first-choice supplier of telephone systems, if we fail . . . well, let's make sure we don't.
(01-432 5488)

Who needs call logging?

by **Nick Furley** LES5.3.5

British Telecom does. And for a number of very good reasons.

Never before has there been such a rapidly changing environment for British Telecom. There was first the introduction of the Telecommunications Act 1981, then the regulatory requirements necessary for the granting of a licence (which demand that Telecom is able to offer itemised bills to its customers), relaxation of our monopoly over various aspects of telecommunications with the consequential advent of competition, the splitting into National Networks, Local Communication Services and making areas profit centres – all bringing a host of problems in billing and accounting.

Of a total turnover of £6,377M in 1982/83, £3,408M is attributable to telephone call charges. Very little information is available about the calls which generated that revenue, either to the business or to our customers.

Traffic recording information is available at various points in the network and call revenue apportionment (CRAM) logging equipment (an expedient to aid revenue apportionment) — installed recently on routes out of local exchanges – provides some call details but only on a sampling basis and falls well short of business requirements.

If it was possible to collect all call details, (in an analogue network, there is only one place that can be done – at the local exchange) then with the appropriate call charging rates, it would be possible to derive the charge for each call at the local exchange, aiding the production of itemised records for customers and a multiplicity of other revenue and statistical information.

The benefits

Considering the changing climate mentioned, a number of benefits could be obtained from having call details and revenue information available locally –

- flexibility of charging to meet competition
- revenue apportionment within the business
- revenue accounting
- itemised billing for customers
- statistical data
- call charging data on-line to billing computer
- charging databases on-line for tariff revisions
- area control of billing

Recognising that such a system was essential to the business, Telecom invited 11 companies, internationally, to tender for the development and supply of a call logging system. Three such systems are now under competitive development, by Plessey, GEC and IBM.

It is intended that the developed system not only logs the call details, but also processes them to calculate the call charge. This will be by a method entirely different from the way in which calls are currently charged. In analogue exchanges, calls are charged by counting periodic meter pulses generated at a rate related to the destination of the call, the time of day, and the class of service or tariff group of the line. The pulses are generated remotely from the local exchange for IDD and NND (national network dialling) calls. Only four charge bands are available for national calls, with two tariff groups. The call logging system will charge for calls by determining the destination of the call (from the dialled digits) the class-of-service of the line, the start-time of the call (by one of a number of options) and the duration.

The system will be capable of discriminating between 8000 dialled codes, each of which will be allocated one of 64 charge bands.

Each customer can be given one of 20 tariff groups. The system will use a combination of charge band, tariff group and time-of-day to determine the appropriate charge rate for the call. At the end of the call, when the duration is known, the duration will be multiplied by the charge rate to obtain the charge for the call.

The equipment at each local exchange will be connected by a data link – either private circuit or public switched telephone network – to an area-based data collecting computer; this will be connected by data link to the billing computer.

The improvements in the number of dialled codes, charge bands, tariff groups and charge rates will make the system very versatile and, having the databases in which the charging details are stored 'on line' and under area control, will make changes quick and easy to implement.

The system will provide a wide range of levels of itemisation so that each customer can decide, from a list of options, which types of call he wishes to have itemised on his bill. Charges for calls which are not itemised, and the number of calls, will be held in bulk counters for each line.

The system will generate statistical information by producing detailed records of calls on a sampling basis for up to 16 different types of call, dependent on charge band, each with its own sampling rate, for subsequent processing to produce traffic data.

The system will also generate revenue information by counting call charges and number of calls for approximately 250 types of call, service, destination or route, dependent on the dialled code. The counts will be broken down into tariff group (type of line) so that the total revenue earned from calls made by a particular type of customer to a particular destination can be determined. By allocating revenue counters to areas and to NND and IDD codes, a basis for accurate revenue apportionment would be available. Note that the counts would not be based on sampling but would be true, up-to-date counts of revenue.

The method

Some of the reasons for call logging demanded a solution which could be implemented nationally, rapidly and economically.

There are proprietary call logging systems which can be bought 'off the shelf' but these are connected to each customer's line, making them expensive – and the facilities and performance offered do not meet Telecom's requirements. So we devised an alternative design in which the expensive call logging hardware would be connected at a point of concentration in the exchange – at the first selector in Strowger, for instance, at which point, only 10 per cent of the number of circuits need to be provided. (The average ratio of line circuits to first selectors is about 10:1).

But this design raised problems, in that by logging at a common concentration point available to more than one exchange line, the calling line identity (CLI) is not known. A revised design overcomes this by using the fact that there is a continuous metallic path from the concentration point to the line circuit – the P-wire. If a signal is injected on to the P-wire at the first selector, and each line circuit P-wire is connected to a receiving circuit through a component matrix, the identity of the P-wire can be obtained by decoding the output of the matrix (as in figure 1). →

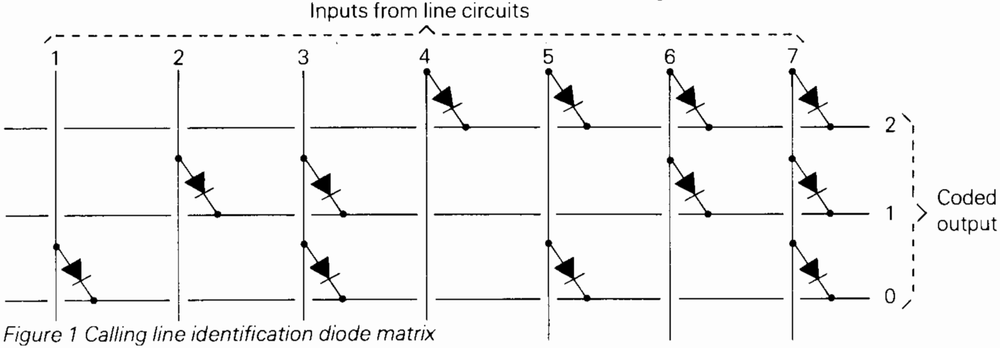


Figure 1 Calling line identification diode matrix

Obviously, the P-wire was not intended for this use and it is essential to ensure that the CLI signals applied do not interfere with the normal operation of the exchange and that the conditions normally occurring on the P-wire do not affect the operation of CLI. The CLI signals used have been selected to fall outside the range of voltage and/or timing of the exchange signals.

The designs developed by contractors vary, but all use the fundamental principle of identifying the calling line by signalling over the P-wire from the logging circuit at the concentration point to a simple and inexpensive circuit associated with each line.

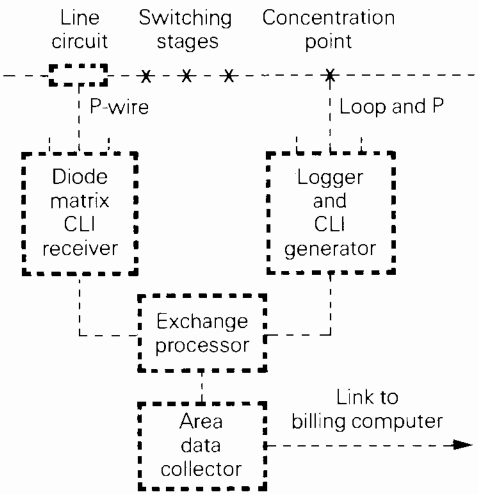
When the CLI signal is received at the line circuit, the identity of the P-wire is translated to the directory number of the line by a processor and associated with the other details of the call logged at the concentration point.

In common control exchanges such as TXE4s and TXE2s, it is possible to obtain the calling line identity from the exchange common control by suitable hardware interfaces. In TXE4s, it is also possible to obtain the dialled digits, reducing the cost of implementing call logging.

The processor will be a small mini-computer with hard disk storage. The dialled codes, customer data such as class-of-service, charge-rate tables, customer bulk and itemised records and statistical and revenue records are held on these disks.

The accuracy and security of recorded data in the call logging system has been given a high priority in the design. Much of the hardware and all of the storage is duplicated, with comparisons made between the two halves to detect errors. Very secure data transfer protocols are used between the local exchange

Figure 2 Call logging system schematic



and the Area Data Collector (ADC) and between the ADC and the billing computer. Back-up storage will be provided at both sites in case of equipment or link failure.

The processing power of the system has been used to make it 'user friendly' by making operation and maintenance easier.

Communication between the user and the equipment is by means of a visual display unit and keyboard. The man-machine interface (MMI) is 'menu' driven so that the operator is given a number of choices from which he selects the transaction or group of transactions required. Requests for input of data to, and outputs from, the equipment are in plain English. A man-machine interface is provided at each local exchange and at the area data collector.

Overall control of the databases for all local exchanges will be from the area data collector. All itemised records and other data generated at the local exchanges will be collected at least once each day by the ADC and subsequently forwarded to the billing computer.

The equipment will detect failures down to slide-in-unit level, and will store details of the failure, which can be examined by the maintenance engineer at the MMI when required. The alarm level of each fault will be programmable. The alarms will interface with the exchange alarm scheme. All circuit boards developed for the system have been designed for fault-finding on the British Telecom's Membrain Automatic Test Equipment located at Area Repair Centres.

The timescale

The need to satisfy regulatory requirements laid down by the government – to ensure that we are granted a licence to provide telecommunications services in the future – and to meet other business needs, demands rapid implementation of call logging facilities nationally.

Three contractors are developing systems, to be installed in four telephone areas – London South, Leicester, Edinburgh and Shrewsbury – for evaluation in 1984. It is intended, subject to satisfactory performance, that contracts will be placed with one or more of these contractors for national implementation at analogue exchanges between 1985 and 1988.

(01-432 2451)

Support for TXE2s

BTNW's TXE2 Regional Service Improvement Centre

by **Geoff Robinson** BTNW/S231

Responsibility for all aspects of TXE2 support throughout the country was transferred from Telecom HQ to BTNW's regional service improvement centre (RSIC) in Manchester on July 19, 1982.

The RSIC provides technical support and back-up for area and regional staff, liaises with Telecom headquarters groups resonponsible for new TXE2 facilities, consults with manufacturers on equipment and documentation problems, and monitors and develops ways to improve service.

Before setting-up the centre, TXE2s were dealt with by several groups in different Telecom headquarters divisions. To provide a more co-ordinated approach, the centre operates as a single group, divided into three sub-groups covering planning, development and maintenance. This provides a number of operational advantages –

- work is easily co-ordinated
- a single source of information is established
- divisional responsibilities are eliminated which dispenses with conflicts of priorities
- staff have a broad appreciation of the various aspects of system support.

Most of the RSIC staff of 14 engineers and two clerical assistants were recruited from within North West region, but some came from Telecom headquarters divisions. Although nearly all had TXE2 experience, a training programme was arranged to familiarise staff with the various 'marks' of exchange manufactured. Initially, apart from the training need, there was a requirement to identify current work from the transferred documents. This was largely achieved during the process of sifting and sorting the files received from Telecom headquarters into one common filing system.

Maintenance

This sub-group consists of four engineers whose responsibilities include system maintenance and routine test procedures, A646 reports, maintenance policy on new equipment investigation of service difficulties, and the evaluation of both retrospective work proposals and service aids.

During 1981-82, Telecom headquarters TXE2 maintenance effort was reduced sharply, causing a substantial backlog of work on A646s, awards suggestions and so on. To ensure that the RSIC was going to meet the needs of areas and regions – and not merely take up work put aside by Telecom headquarters during this period – a maintenance policy meeting, attended by area and regional staff, was held in Manchester to discuss difficulties and update the work programme. A number of the problems highlighted at this meeting appeared to have been outstanding for quite a while: multi-marking for example.

These and other problems were categorised in order of priority and work is now in hand to resolve them: a solution to the multi-marking problem should be available in the near future. Contracts have also been placed for register steering units, test call senders and upgraded matrix testers. Evaluation work is under way for a traffic recorder and access tester, event sequence analyser and for modifications to testers *TRT 200*.

Development

The responsibility of the development sub-group includes liaising with contractors on modifications to new equipment, ensuring that information kept at the documentation centre at Harrogate is up-to-date, and designing new circuits for testers and exchange equipment.

A number of design weaknesses have been pinpointed. Several circuit improvements are in hand, as are proposals to improve the availability of manufacturers' documentation and diagrams. Discussions have also taken place with TXE2 manufacturers for British Telecom to become the design authority and thus have full control of contractors' documentation when TXE2 manufacture ceases.

Planning and Works

This third sub-group is responsible for inputting requests to the IBM computer at Harmondsworth for computer-produced design specifications. They also prepare planning instructions and co-ordinate the introduction of any new services or facilities. But to minimise→

the number of people involved with the handling of retrospective work specifications prior to issue, the responsibility for issuing such specifications has been transferred from planning to the development sub-group.

Work undertaken by planning staff has also included the revision of some 20 *Telecom Instructions* before their replacement by the new Inland Services Information System (ISIS).

Long-term aims

Although there are more modern systems on the horizon, TXE2s still form an essential part of Telecom's switching network and at present account for almost a quarter of all local exchanges. The long-term aim of the RSIC is to ensure that these exchanges can be efficiently maintained for the period they remain in service. Immediate objectives are to provide a day-to-day support service which meets the needs of areas and regions, and to direct effort towards economical service improvements. For the future, we need to ensure that TXE2 exchanges are compatible with new systems being introduced and, where required, provide new customer facilities.
(061-863 7771)

Computer analysis at de Havilland exchange

by **Adam Khan** and **Keith Dunford** BTI/IT4

This article describes modified international accounting and traffic analysis equipment (IATAE) used at Mondial House and Stag Lane to collect, collate and analyse accounting and traffic information.

The equipment used to give these facilities is a DEC System 10 computer, operating in 'real-time', and connected to a Plessey 5005T crossbar exchange. It monitors all circuits and items of common equipment in the exchange through a purpose-built electronic interface.

When a call is set up across the exchange the incoming line relay group (I/C LRG) identity, and the route destination are presented to the interface (encoder), interrupting the computer. This indicates to the computer that a call has been set up between an incoming circuit and an outgoing route destination.

All exchange equipment is scanned every one second, 20 ms or 40 ms, according to the holding time of the equipment. Changes of states are detected, and groups of scan-points are connected to an interface (concentrator) for interrogation by the computer. See figure 1.

Call duration counters – held in core memory – are incremented each second (line relay group scan rate) while the call is in progress, the counters being arranged for the three charging rates: peak, standard and cheap. Every 30 minutes the file is 'dumped' to a disk store and reset to zero, then the buffer is cleared ready for the next 30 minute period.

The accounting files on disk are transferred to magnetic tape each midnight for security reasons, and at the end of each month the files are reset to zero.

The data accumulated by scanning all parts of the exchange forms a database from which traffic can be analysed and various data printed out on request from a terminal user. Accounting data is accumulated for periods of one calendar month, but all other exchange data is overwritten every half-hour. So if traffic data is not requested, it will be lost. Users may request long print-outs to be output on a high speed line-printer in the computer room.

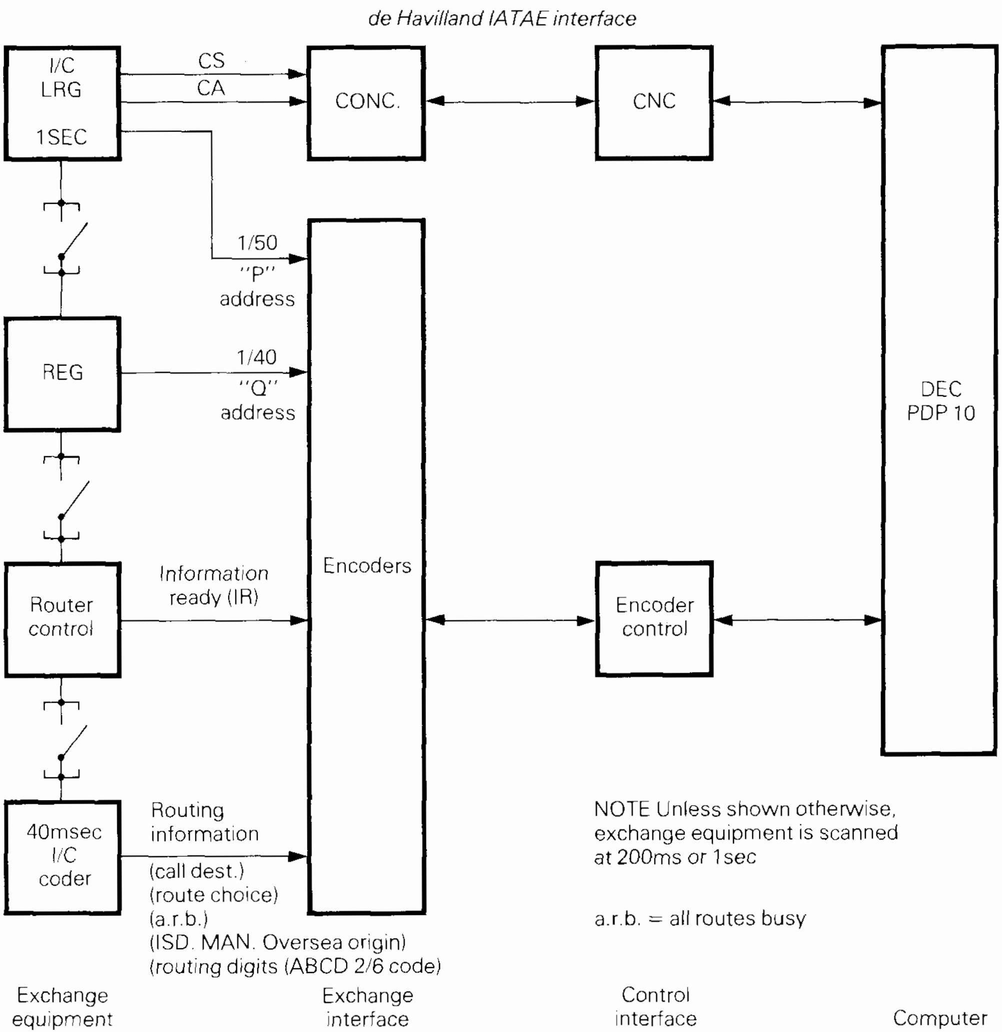
Functions of the IATAE

□Accounting data

When an international call is dialled the customer's meter records the charge which will be billed to the customer. The charge to be credited to the destination country, however, must be recorded by other means. IATAE performs this by totalling paid time to the particular destination.

□Traffic analysis

The International Reference Centre obtains daily printouts on their terminals in order to present statistics on the performance and incidents affecting quality of service. The output data is forwarded mainly to groups responsible for settling accounts with foreign administrations.



□Maintenance aid

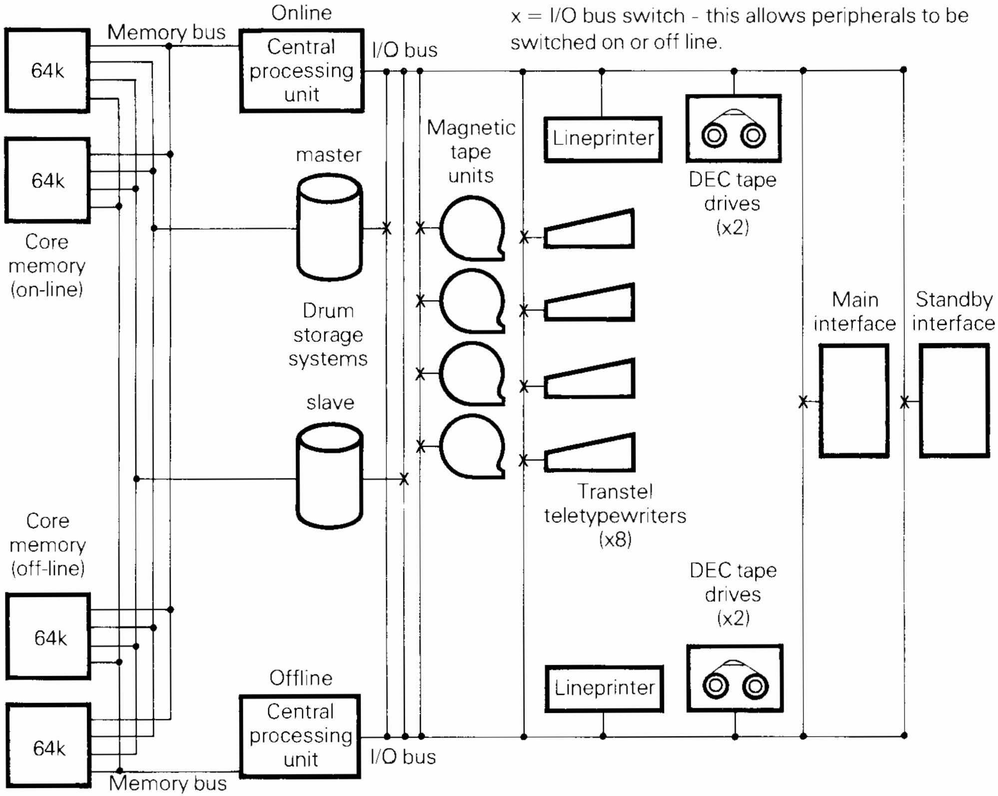
The IATAE is used as a maintenance aid by International Switching Centre (ISC) staff. Information about the exchange performance may be obtained on demand from their terminal in the ISC.

It is also used as a maintenance aid in the International Transmission Maintenance Centre (ITMC) where print-outs are obtained on any circuit not performing within certain pre-set 'norms'. Demands may also be made – from their terminal – for performance information on all circuits on a specified route.

Initially, the reliability of the PDP10 system was not good, due mainly to the original core memory being fault-prone and difficult to maintain. Also, the original memory-bus cables contained active components and used wire of relatively high resistance. Substantial improvements were obtained by installing a new version of core memory, new low-loss memory-bus cables without active components (less fault liability), together with new drum storage. An added advantage in replacing the core memory was a reduction in power consumption, allowing the room to remain at a cool and stable temperature which reduced the number of transient faults. It was found that nearly every time a rise in temperature occurred due to a malfunction of the cooling plant, there was an increase in system failures. →

Maintaining the PDP10

☐**Preventive maintenance** – consists of periodic checks of mechanical peripherals (with adjustment where necessary) and checks of the improved core memory. The rest of the system used to be checked by varying the supply voltage to the equipment modules, but this procedure has been abandoned, since the manufacturer no longer recommends it. Our experience, trying to force manifestation of an intermittent fault, resulted in 'blowing' other modules which were operating satisfactorily. The system is now 12 years old and – with ageing components – this method would have increased the problem.



x = I/O bus switch - this allows peripherals to be switched on or off line.

☐**Corrective maintenance** – takes place after a system failure. The procedure is to run diagnostic programs to help maintenance staff analyse fault conditions and to locate a faulty cabinet. More refined diagnostics are then run to locate the faulty module. The system software is of little help when reporting an error condition, and the diagnostics do not report which card is at fault. Maintenance staff have to deduce which instruction is failing and then resort to tracing signals using an oscilloscope and flow diagram, to locate the faulty module.

The software programs are written in the computer's assembler language – Macro 10. The on-line 'Top 10' software (a time-sharing operating system) was modified by Plessey to include other facilities – real-time processing for example – which were not supported by DEC.

System failures

Following commissioning, system failures were predominantly hardware-originated, but these were overcome by the improvements mentioned, and an increasing awareness by maintenance staff of the nature of the system failures. As an example, hardware 'crashes' were occurring up to 40 times a month but now occur only three or four times a month. Software problems occur five or six times a month, and have done since the system was commissioned, but it is expected that the much improved performance of the IATAE can be maintained – providing its environment is kept cool and stable.
(01-357 4530)

Master clocks go electronic

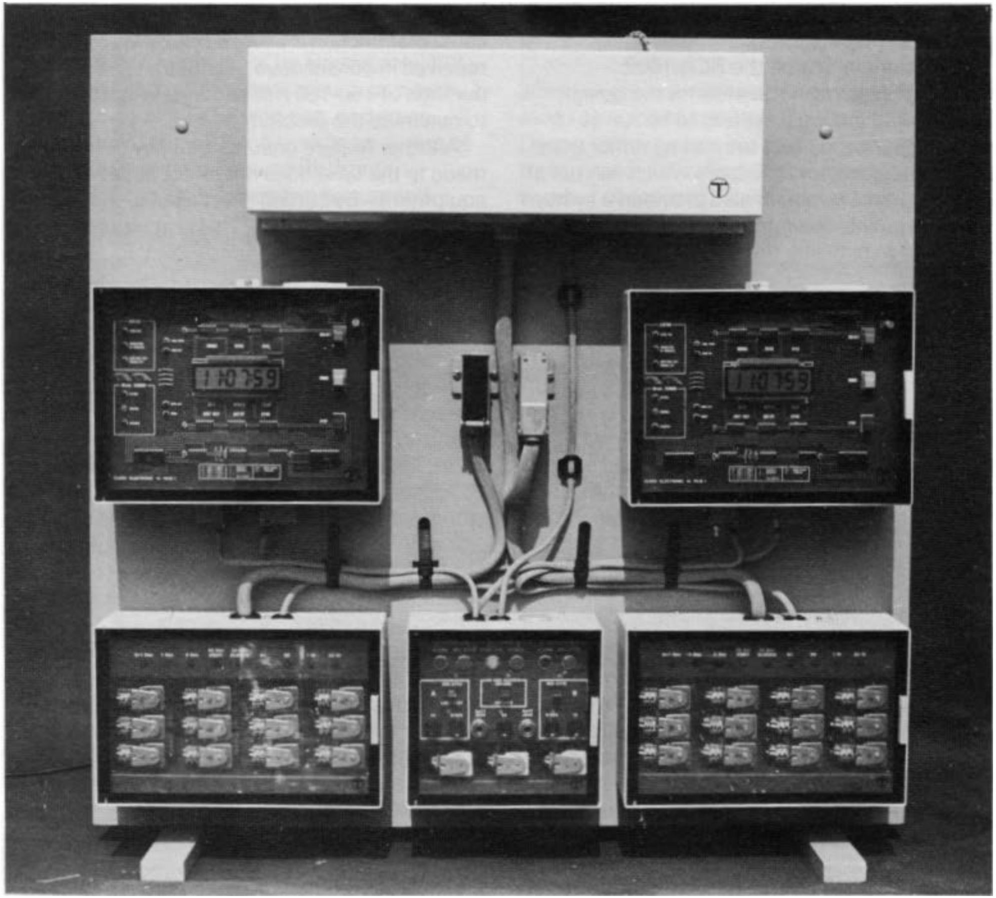
by **RDK "Jeff" Jefferson** BT East/MCE2242

A few years ago Telecom headquarters was looking for a new clock to replace the Clock 36 – an electro mechanical impulse clock which has been used in telephone exchanges for many years for generating 1, 6 and 30 second timing pulses. These old clocks were causing problems due to erratic time-keeping and with difficulty obtaining spares. About this time, British Telecom East's electronic development group were designing tariff rate inspection and checking equipment (TRICE) which needed an accurate digital clock. To achieve this a circuit was devised to monitor the Speaking Clock and to produce a synchronising pulse once every ten seconds to eliminate timing drift due to crystal or temperature variations. The circuit (TIMLOC) functioned well so Telecom headquarters commissioned us to produce a protoype electronic clock with TIMLOC, to replace the Clock 36.

The main aspects of the new design were ease of maintenance, accuracy of timekeeping and the possibility of introducing several new functions which had not previously been thought practical. Some of these new facilities were: the accurate control of the duration of output pulses, the possibility of pre-setting or 'programming' the change from GMT to BST (or *vice versa*) and including a day and date display.

The original design was based on the use of standard CMOS logic circuits, which give low operating power and high noise immunity. The ►

Complete system for an exchange electronic clock IA.



disadvantage with this approach was that the number of integrated circuit packages increased with each additional facility, making further alterations more difficult and the cost of the final design prohibitive. The solution was to use a microprocessor, subject to satisfactory noise immunity and power requirements.

After some research the RCA 1802 microprocessor was selected for the design. This allowed the logic system to be run at 10 volts to give good noise immunity, rather than conventional microprocessors which can run at a maximum of 5 volts. It also provided a system with low power consumption, which had the benefit of minimising the cost of the power supply and enhancing component life. Using a microprocessor also meant that additional facilities could be included merely by altering the program, without modifying the circuitry or re-designing the printed circuit boards. Finally, a method of using the microprocessor crystal to provide the clock timing, without external circuitry, reduced the cost and provided a structure for the microprocessor program.

It was also fairly easy to re-design the original TIMLOC circuit to allow the occasional 'leap-second' alterations to be tracked automatically, and for corrections up to five seconds – rather than half a second – to be applied where necessary. Another feature of the microprocessor version of TIMLOC allows corrections to be gradually applied, rather than immediately, so the effect on output pulses does not adversely affect dependant equipment.

A leap-second is used to correct for variations between the speed of the Earth's rotation and an atomic standard such that time standards – including Telecom's speaking clock and GMT – are maintained to internationally agreed limits.

Design features

The first design feature was for a shortened but strictly-controlled output pulse duration. The old system produced pulses of typically 500 milliseconds duration and it was found that some equipment – Clocks 96A for example – could malfunction if several pulses were received in consecutive seconds. A pulse duration of 150-160 milliseconds was specified to minimise the problem.

Another feature ensures that any corrections made to the time does not affect dependant equipment – by cutting short a pulse that has just started for example. This is achieved by the RCA 1802 'reading' the time when a synchronising signal is received, calculating the error, and applying a correction by altering its speed by a factor of 1 in 64 until the necessary adjustment has been made. An indicator on the front panel shows that this is taking place.

A third facility is the ability to 'program' the half-yearly change from GMT to BST or *vice versa*, so that all clocks and other exchange equipment can be altered at the correct time without the need for maintenance staff to attend. Although it would have been possible to program the clock to carry out these changes automatically, this option was rejected, in case the actual dates of change-over were subsequently altered. As a result this function is set by the user at any time during the week before the change-over is due.

The principle of not drastically altering output pulses during time corrections, was applied to the 'Advance/Retard' key used in conjunction with the 30-second clock output. The new 'Advance/Retard' key is not connected to the 30-second output but is simply monitored by the processor shortly before each pulse is produced. In this way the output is unaffected, even if the key is moved while a pulse is present.

Other features

As it was thought that there might be some benefit in having the date and day-number available these features have been provided. It also seemed desirable to be able to use this information remotely from the electronic clock itself – to control routiners or central-heating boilers for example. This led to a further development, which was the provision of a 'data stream' giving current time, date and day number for use by remote equipment.

To minimise wiring requirements a digital slave display is included, which needs no connections except the 2-wire data stream and uses very low power, so that 50 or more can be connected in parallel across one feed. Using a four-digit display the slave shows the time in 12 or 24-hour format, or the date, controlled by two push-buttons. A further development is envisaged that will allow this sort of slave to control other equipment as mentioned previously.

To date, about 15 clocks have been made for evaluation trials and the project is being considered by Telecom headquarters for use in TXE4 exchanges. Plessey/ICL have also ordered prototypes, for evaluation with their new customer billing system.

The complete system for an exchange comprises two electronic clocks, two relay sets, one control unit and one distribution unit, all mounted on a wall-board as shown in the photograph.

(0206 67545)

Remote Alarm Concentration Equipment – RACE

by **Alan Kirby** BT East/MCE224

A conventional alarm circuit between exchanges uses one pair of wires and a dc method to indicate the exchange status. But as the number of exchange alarms increases this system becomes unacceptably wasteful in terms of line plant. The solution is to use one pair of wires to transmit information on several alarms. The equipment described in this article is one way of achieving this.

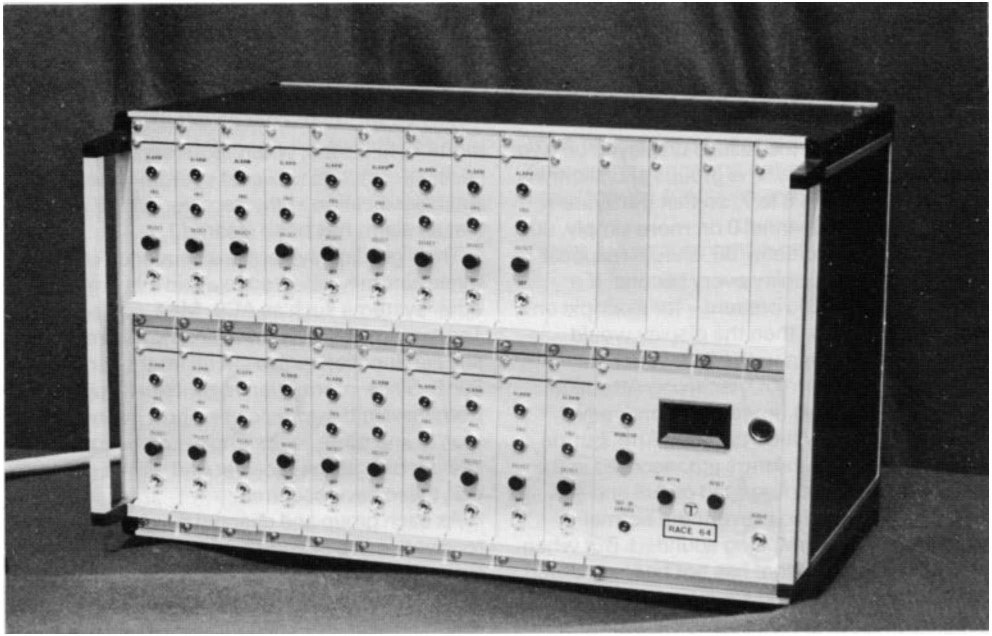
For simplicity of design and to improve response time, it was decided not to send any information if none is required. This deceptively simple approach means that no time is wasted if an alarm is in its normal condition. Therefore only active alarms are transmitted. Unfortunately if no alarms are active no information is transmitted to the receiver – a situation indistinguishable from a fault condition in the alarm system itself.

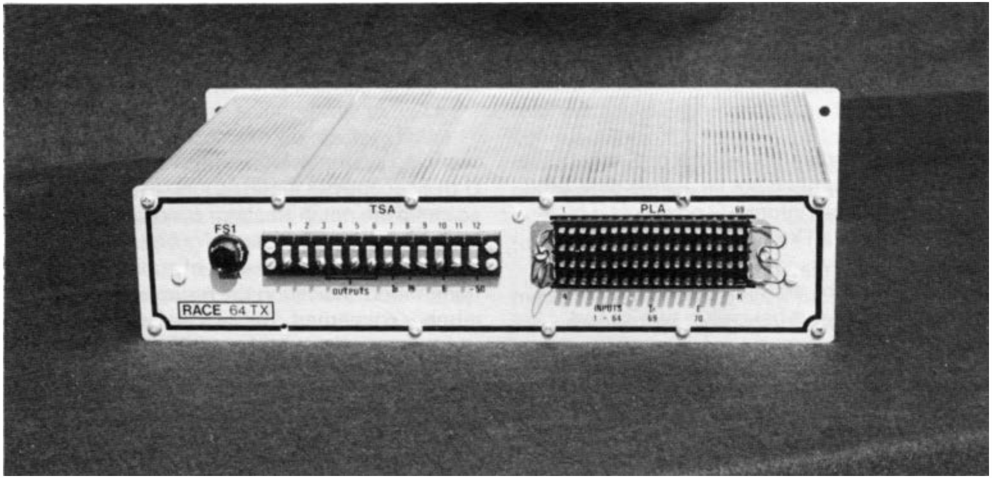
To eliminate this problem one of the exchange alarm inputs is reserved as a system guard and is permanently wired as an active alarm. This means that the receiver should see at least one alarm at any time so that if no alarms are received then the system has failed. Provided that the system can cater for a reasonably large number of alarms the loss of the use of one input is acceptable.

The final design of RACE caters for 64 inputs, considered as eight groups of eight channels each, with the first channel of the first group reserved as described. The other 63 inputs may be allocated by the user as required. In fact, the information sent need not be alarms only, but may include other information such as which security side of a TXE2 is in use, and so on. All that is necessary is for the user to be aware of what each numbered input represents.

The transmitter is basically a two-speed scanning system which runs at high speed (1 millisecond per input) as long as the inputs scanned are not in an alarm condition, but which stops on each active alarm for one second. During this time two bursts of audio tones are transmitted, indicating the group and channel number concerned. These tones are decoded →

Race 64 receiving system equipped with 19 receivers





Race 64 transmitter

by the receiver and the results displayed on two seven-segment LEDs. The groups and channels are numbered from 0 to 7, so that the system guard is group 0, channel 0 or, more simply, 00. Under normal conditions '00' should reappear on the receiver's display every second. If a genuine alarm is also present – for example on group 2 channel 7 – then the display would show '00' alternating with "27".

A very simple form of 'Receiving Attention' facility is provided at the receiver end, which works as follows. When the 'Rec Attn' button is pressed, all existing alarms are recorded in the receiver's memory integrated circuit and this information is used to prevent the normal audible warning from being sounded. But when an alarm is received that has not been recorded in memory, the warning sounds. A 'Reset' button is also provided to clear the alarm memory to normal when required. (It is not possible with this low-cost system to provide an audible indication at the receiver end to indicate that an alarm has been cleared.)

The signalling system is a sequence of audio tones carefully selected to avoid interfering with other systems such as AC9, MF4, and so on. The system will work over unamplified circuits and can function with a circuit attenuation of 30dB. Since information is continually repeated from transmitter to receiver, short interruptions (due to line noise for example) can be tolerated and the user at the receiver end will be unaware that these have occurred.

As each group and channel number is received, a five-second timer is re-started to await the next pair of signals. If none have been received within the five seconds a system failure has occurred and this is indicated by a buzzer and a light-emitting diode. A switch is provided to turn these off if the system cannot be restored immediately.

The transmitter unit is approximately 10 inches wide, 2 inches high and 8 inches deep and draws about 70 mA from the exchange −50V supply. The unit may be mounted anywhere in the exchange, since there are no special cabling requirements. The inputs are arranged such that an open circuit or a voltage more negative than −10V is considered normal, while an Earth is the expected active (alarm) condition. The input impedance is very high (over 100 000 ohms) to prevent loading the alarm circuits. The inputs are fully protected against noise 'spikes', which could otherwise damage the circuitry or cause mis-operation.

The receiver units are slide-in modules mounted in a standard 'Vero' case. Four case sizes are available, catering for up to three, six, 10 or 24 receiver cards, plus the single common control unit. Receivers are designed for use in offices rather than exchanges and are powered from the normal mains supply. The largest case size is only 17 inches wide, 11 inches high and 11 inches deep, making it suitable for desk-top use.

The control unit is necessary to allow the user to concentrate on alarms from one exchange at a time without being distracted by alarms from other units. The control unit also reduces costs, since only one pair of seven-segment displays is required, rather than one pair for each receiver card. The same cost-saving applies to the 'Rec Attn' and 'Reset' push-button switches.

To date, some 300 systems have been built for use in a variety of circumstances. Further information is available from BT East MCE 224. (0206 46436)

Signalling system CCITT6 maintenance

by **David Mooney** BTI/IT4/MS1.1

The common channel signalling system known as CCITT 6 was first recommended for use as an international standard in 1968. Following this British Telecom took part in a trial, using the Wood Street international services centre (ISC). In 1980 a service was introduced between the Thames B (TXK6) ISC and the United States. The UK currently works to five countries and plans to increase this to 10 by mid 1985.

Maintenance of common channel signalling equipment is substantially different to other signalling systems and is particularly interesting in the context of the planned national and international expansion of common channel signalling. This article outlines the experience gained on the Thames B ISC.

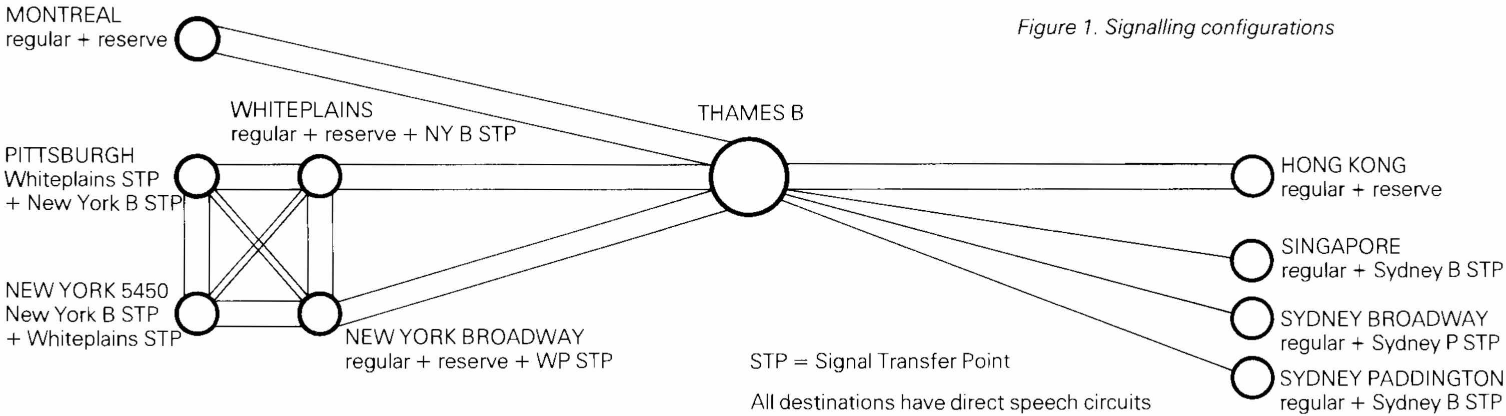
Description

Common channel signalling means that all signals for a group of speech circuits are passed over a common signalling link. A data link is used for this purpose which can carry telephony signals for up to 2048 speech circuits, and signals to control the link and network status. To avoid loss of these circuits in the event of a link failure, reserve link facilities can be provided which are capable of taking over signalling without affecting the telephone traffic. A reserve link can be a synchronised standby, or a signalling path through another exchange which acts as a signal transfer point (STP). It is also possible to have no signalling link directly associated with the speech route, so that all signals are passed through the transfer point. Figure 1 illustrates the signalling arrangements at Thames B.

The removal of signalling from the speech circuit to the common channel makes it necessary to perform a continuity check of the speech circuit before conversation. The initiation of a call by sending a signal on the common channel, instructs the receiving exchange to connect a loop in the both-way termination. A tone transmitted on the speech circuit by the originating exchange is then returned round the loop and checked. A transceiver is connected at the originating exchange for this test.

The hardware required in a typical stored program control exchange is shown in figure 2. Link synchronisation and error-rate monitoring is usually performed by a front-end processor. The main exchange processor handles call processing, signalling network control, maintenance functions and so on. →

Figure 1. Signalling configurations



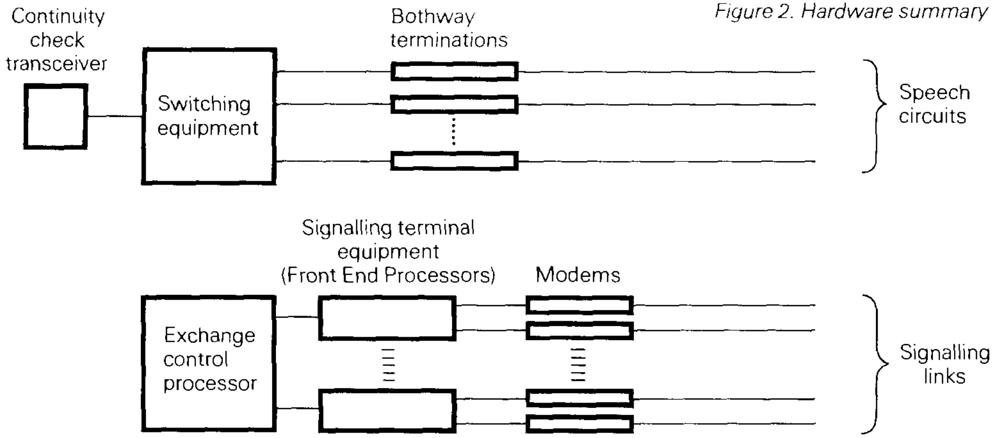


Figure 2. Hardware summary

Thames B experience

Generally, faults are detected automatically giving an alarm and printout. In the case of a signalling link failure, for example, the exchange redirects the signalling traffic on to a reserve link without manual intervention. The exchange must be capable of making many decisions, dependent upon the status and configuration of its signalling network. However, localisation and correction of faults requires the use of maintenance procedures, facilities and analytical skills. There can also be occasions where no reserve facilities are available and urgent remedial action is required. The action taken and the maintenance facilities used will depend upon the nature of the failure – hardware, software, compatability with other exchanges and so on.

- Link failures cause printouts indicating the reason for failure (high error rate for example). The data links conform to CCITT recommendation M1020 and normal transmission checks apply. In addition, an error rate check using a 511-bit sequence tester can be used. Modem failures can be located using an automatic loop test initiated by typing a command.

In practice short failures of the links are common due to noise bursts, for example, and no maintenance action is required. In this event the failure causes signalling traffic to be transferred to the reserve until the failed link re-synchronises and passes a proving period. The procedure is performed automatically, but maintenance staff monitor the frequency of such re-configurations and investigate if the failure rate becomes too high.

- Terminal adaptation equipment failures can be investigated with the use of diagnostic programs. In the Thames B exchange very few faults occur in this equipment.
- Speech circuit faults can cause continuity check failures. An automatic repeat continuity test call is made using a different transceiver. If this also fails a speech circuit fault is assumed. Normal circuit maintenance procedures are used. In addition it is possible to initiate continuity test calls by command. If the automatic repeat continuity test call succeeds it is likely that the transceiver is faulty. A continuity test call can be ordered, using the transceiver, to aid maintenance.
- In addition to hardware malfunctions, experience has shown that severe difficulties can be caused by software (programs and data) or compatability problems caused by different interpretations of the specification. The effects of these failures can be diverse and difficult to identify. To analyse these problems maintenance staff need to have a good knowledge of the system, the signalling configuration and so on, and have methods of extracting relevant information.

Maintenance aids

Facilities at Thames B ISC to give CCITT 6 information, include –

- Commands and printouts. Commands are used to block equipment, initiate tests, enter data and print information. Printouts supply details of failures for investigation and records.
- LED panel. 16 rows of 18 lamps display exchange store data and usually shows the CCITT 6 link states and is especially useful when investigating the effect of actions on the link state during fault diagnosis. It has advantages over printouts but requires familiarity to interpret the display. The number of links that can be shown at one time is limited.

- Electrospace tester. Displays all or selected signals on a datalink. It is microprocessor-based with visual display unit and printer output and has been extremely effective in fault investigation. For example, by printing the synchronisation and acknowledgement signals during synchronisation, the synchronisation procedure can be investigated, and link propagation delay assessed.
- APN tester. This is used on the regional processors which are part of the terminal adaptation equipment, to read and write in the processor's programs and data. The tester is most useful for analysing software faults in the regional computer.

Compatibility tests

Because CCITT 6 signalling is complex and implemented in different types of stored program control exchanges, compatibility tests are performed between exchanges before service is introduced. A standard CCITT test schedule has been published and the extent of testing performed is mutually agreed between administrations depending on whether the exchange is carrying live traffic, or if that type of exchange has been tested before and so on. The tests carried out by maintenance staff cover:

- Preliminary data link tests
- Synchronisation of data links
- Security arrangements for link failures
- Terminal call processing
- Transit call processing
- Signal transfer point call processing
- System failures
- Automatic Transmission Measuring Equipment (ATME)

Compatability testing at Thames B identified a number of problems prior to service introduction. It is also interesting to note that compatability problems have been discovered between exchanges of the same type, due to generic differences.

New maintenance facilities

From experience, additional facilities have been identified which are useful for planning and maintenance:

- Signalling performance monitor – to be introduced at Thames B ISC to monitor the performance of a link or set of links – will provide better information on failures and can be used for maintenance, or planning the optimum signalling network.
- Signal generation and monitoring facilities being introduced to aid compatibility testing. It will be possible to generate some of the abnormal sequences described in the CCITT test schedule. The monitoring function will correlate signals and changes in the status of the signalling configuration.

The future

The CCITT 6 network will continue to grow worldwide before eventually being replaced by common channel signalling system CCITT 7. The experience gained at Thames B ISC shows that commissioning, including maintenance procedures, facilities and skilled staff, are all essential for efficient maintenance of common channel signalling systems.
(01-936 3248)

Tabletop payphone

by **Brian Everitt** CE4.2.2

The renter's Tabletop Payphone (Coin Telephone 23) is a line powered, self contained, microprocessor-controlled telephone, capable of working as a direct exchange line or as a payphone with restricted facilities. It is designed for use in such supervised locations as shops, public houses and reception areas.

In its 'ordinary' mode – with the lockable mode switch in the 'O' position – the CT 23 works as an ordinary telephone, with full access to IDD, STD and all operator services. By turning the mode switch to the 'P' position, the renter can convert to restricted payphone working.

When working as a payphone it will accept 2p, 5p, 10p, and 50p coins but there is no access to operator services. However, '999' →

Coin Telephone 23

calls can be made without inserting money.

The telephone is plug-ended and can be free-standing, screwed to a shelf, or secured by a chain, to give flexibility of movement with a measure of security.

Unlike the new range of electronic public payphones, the CT 23 has no self-diagnostic or automatic reporting facilities. A faulty CT 23 normally receives maintenance attention on-site, rather than a complete change of mechanism, as was the case with its pay-on-answer predecessor. This is achieved by use of a field maintenance pack, containing instructions, tools, and hardware necessary to effect on-site repair.

Flow charts are used to guide the faultsman through a series of functional checks. When a particular failure is detected, the flow chart contains instructions on replacement of individual parts or complete modules, all of which are provided in the field maintenance pack. Very few mechanical adjustments are carried out on-site.

All faulty parts are returned to the Payphone Maintenance Centre (PMC), where mechanical repairs and adjustments are carried out. Parts requiring electronic repair will be sent to an Area Repair Centre for attention. The field maintenance pack is replenished with good stock from the PMC to maintain it in a state of readiness for further use.

Experience gained so far indicates that the CT 23 will be a reliable addition to our range of payphones, requiring infrequent maintenance. A wall-mounted version is being developed, and the success of the basic CT 23 payphone mechanism may well lead to its future use in other applications.

01-432 2774

Radio Interference and CB

by **Roger Williams** BTM/SLX 1.4.4

Citizens' Band (CB) Radio brings to mind the adage – that beauty lies in the eye of the beholder. Some people regard CB with great delight while others regard it as the biggest nuisance yet devised. Whichever way you feel about CB, there is no doubt that it is here to stay – as will be the radio interference caused by its use. This article highlights our experiences with CB interference over the last three years and our efforts to minimise it.

Information can be gleaned from technical publications on the likelihood of interference being caused – due to intermodulation, crossmodulation, spurious emissions, spurious responses of receivers, blocking and so on when operating transmitters and receivers close to each other. In this article these terms will only be referred to when necessary, as much will relate to field experiences.

It was thought that the most likely service to suffer interference from the use of amplitude modulated transmitters operating on 27 MHz, would be hospital paging systems. Although interference did occur, it was by no means as prevalent as was expected. Typical examples were when 'mobiles' – CB users – were parked next to a hospital, or when a nurse in a nearby nurses' home used a base station set. Naturally the hospital authority concerned complained bitterly and demanded immediate attention – especially when the cardiac arrest team were alerted unnecessarily, as happened on occasions.

Radio controlled model aircraft were also expected to be affected and this certainly was a troublesome area with complaints of several expensive models crashing, to the anger of their owners. One or two reports suggested CB operators were deliberately operating where models were flying to get sadistic pleasure from the devastation they could cause. In the Midlands one such offender was brought to court for this offence.

Householders' complaints

By far the greatest outcry was from the general public using tv and radio receivers and hi-fi audio equipment. The number of complaints was so great that a considerable delay built up in the investigation of these cases. Proximity to the CB transmitter was the root cause of the problem in most cases, and it mattered little whether or not the complainant resided in an area of high field strength. This is because in an area of high field strength from the local tv transmitter, viewers tend to rely on set-top aerials or, at best, loft aerials of dubious quality, either of which may perfectly adequate in the absence of interference. Inspection of aerial and feeder cables often revealed unsoldered joints at the coaxial plug, taped joints in the feeder cable, or corroded terminations on the aerial itself – all of which, of course, gave rise to poor signal strength.

Solutions

Manufacturers of receiving equipment are notified of the findings of our investigations, and whether we have been successful or not. An analysis of these returns has shown that feeding mains leads, aerial leads or – in the case of hi-fi associated systems – speaker leads, through ferrite rings to be most effective in attenuating the interfering signal. A number of component manufacturers have produced new filters, or have modified existing filters, which have been effective against CB interference. The Home Office has now changed its policy on filters, permitting their free supply to combat the CB interference problem.

The main problems

The most serious problems have been those interfering with safety-of-life communication systems. The operation of a large number of transmitters at 27 MHz has given rise to a number of complaints – due to the emission of the third harmonic from the transmitter or the production of the third harmonic within the receiver. The original amplitude modulation (AM) channels were so related in frequency that interference could be caused to Police communications. Unfortunately, the choice of frequencies for the new frequency modulation (FM) service means that any third harmonic produced can affect the Fire Service. The third harmonic from a transmitter is required to be 60 dB down on the fundamental carrier frequency and, unless the distance between transmitter and receiver is small, this is usually sufficient. But there are three factors which can cause this to deteriorate –

- First – as in any apparatus – a fault can develop giving rise to a higher level of harmonic being generated. (Someone may have tampered with the set with a screwdriver to 'tweak' it for greater power output).
- Second, a CB operator may feel that he is unable to contact enough stations and so installs a larger aerial (because his dealer has convinced him that he needs one). If this is not completely successful, he may add a power amplifier (often called a 'burner' by the CB fraternity) between his CB transmitter and the aerial. Although sometimes called linear amplifiers, they should perhaps be called harmonic generators.
- The third possibility is the use of equipment with diodes across the transmitter output. This is the case with standing wave ratio (SWR) 'bridges' or receive pre-amplifiers with diode detection switching to mute the receiver when the transmitter is operated. Both these devices will increase the third harmonic by as much as 30 dB.

Finally, an aspect of CB interference investigation that is very time-consuming is a problem caused by CB-ers to their own fraternity. Many licence holders think that the licence entitles them to protection against all forms of harassment, for example foul-mouthed individuals jamming or over-riding other licencees' transmissions.

This short article has mentioned a few of the difficulties experienced. Others – such as the recent Press reports on petrol pump frauds – will doubtless be brought to light as time passes.

(021-262 4755)

Replacement plug blades on Signalling system multifrequency No 2 (SSMF2)

Damaged or worn edge-connector plug blades on early SSMF2 units (Tp 55609/10 and so on) can usually only be replaced by modifying the unit framework and fitting a later type plug.

For anyone in this situation faced with replacing plug blade 5/DCO/122, I have a small stock of this normally unobtainable item.

Requests for plugs (not for local stocks) should be sent to –

Terry Sadler
LES5.2.4
Room 328
Procter House
100-110 High Holborn
London
WC1
(01-432 2300)

PCA25 measurements at RSCs

by **Tony Richardson** LES6.1.4

The quality of service at direct reporting repair service controls (RSCs) for '151' calls, and fault report calls from auto-manual centres (AMCs) is expressed in terms of 'percentage of calls answered in 25 seconds or less' – and is commonly referred to as 'PCA25'.

For the past 10 years these measurements have been carried out by a Strowger-type relay set and mechanically-operated meters – usually rack-mounted on an equipment floor away from the RSC. Although it was possible to have an additional group of meters sited in the RSC, this facility was seldom provided.

A group of five meters was provided for every nine (or part of nine) incoming circuits and it was possible to connect a circuit occupancy meter for each circuit, giving the following information –

- calls answered in 25 seconds or less
- calls answered after 25 seconds
- calls to 'busy', where modular RSC call distribution equipment is provided
- calls abandoned in 15 seconds or less (these calls are not included in the PCA calculation as they are assumed to be misroutes)
- calls abandoned after 15 seconds

Development

Modern technology, and the increasing difficulty in obtaining Strowger components – particularly Type 4 uniselectors used in the relay set – made it necessary to consider urgently an electronic replacement for the electro-mechanical PCA 25 equipment.

To achieve this, a Monitoring Unit 33A has been introduced which provides the required information more easily, without the need to read meters. This unit will be available, initially, to those RSCs where the new repair service strategy is being implemented (explained in *MN 18*, Spring 1981) and to reduce outstanding orders for PCA25 equipment.

The design is based on an Electronic Pulse Generator 2A (EPG 2A), with additional hardware to interface with the exchange. Information is stored and recovered by means of a keypad, controlled by a security code and a six-character LED numerical display.

The unit is normally desk-mounted, but a kit of parts is available to allow either wall or rack-mounting, if preferred. It is designed to give two independent modes of operation – manual or cyclic:

Manual — allows monitoring to take place at any time of day, for any length of time, by a simple key operation to start and finish the monitoring period.

Cyclic — allows monitoring between specific days and between specific times, on a weekly repeating basis. For example, if the unit is set to operate from Monday to Friday, 8am to 5pm each day, this will be repeated every week with the calculations for the previous week being stored for reference.

The unit provides percentage read-outs instantly when required, as well as those previously given by the mechanical meters. In addition circuit occupancy is provided, calculated in minutes.

Field testing

Three units have been tested in the field, alongside the electro-mechanical type. Some software modifications were found to be necessary but production of Monitoring Units 33A is now under way.

Planning and installation

As previously mentioned, units can be sited on a desk in the RSC, mounted in a console, or fitted to a rack (similar to the mechanical-type mounting). Each unit monitors 10 incoming circuits (compared with a maximum of three circuits per strip on the mechanical type) and requires a maximum of 32 connections to a tag block mounted inside the unit, made up from –

- 10 'L' wires (calling lamp earth leads)
- 10 'S' wires (answering battery leads)
- 10 'busy' wires (if required)
- 2 wires for battery (−50v) and earth, fusing 1Amp.

The 'L' and 'S' wires are taken from the incoming relay set or interface – depending on access arrangements to the RSC. A no-break power supply is essential, as no storage is provided, and any power failure in the unit will result in the stored information being lost.

Connections to rack common services are not required.

Drawings, specification, diagram and circuit description are available (Diagram Notes AT/ATW 625950). The unit can be replaced easily in the event of component failure.

The colour scheme blends with the PSA Whitley range of furniture, and the display and keyboard is angled at 30 degrees, for comfortable viewing and convenience of operation.

(01-432 2876)

Idis to Isis

The Spring/Summer 1983 issue of *Maintenance News* gave details of the new Inland Division Information System (IDIS) designed to replace the TI system insofar as it affected Inland Division.

Because Inland Division ceased to exist from September 1, 1983, a new title had to be found for the TI replacement system. This will be introduced as planned to meet the requirements of Local Communication Services (LCS) and National Networks (NN), but under the revised title: Inland Services Information System (ISIS).

Brian Grover
IDP5.1.4
(01-357 4138)

New technique aids line-up

by **John Humphreys** TSO1.2.3
and **John Clarke** TSO2.1.1

A new transmission-level check procedure has highlighted performance deficiencies in second-generation routiner answering (RA) equipment at TXS, TXK and TXE exchanges.

The procedure – detailed below – has been introduced for providing new main network public circuits, but can equally well be used by maintenance staff to check for transmission losses.

The main advantage of the technique is that checks are done from one end of the circuit only – the outgoing end – without the need for far-end cooperation. This gives significant savings in circuit provision time.

Method

The RA equipment at the incoming exchange is accessed over the newly-provided circuit under test. At the outgoing exchange, a low-level 800Hz tone is applied to the circuit through a variable attenuator so that it is received by the RA equipment detector below its triggering level of −22.5dBm. The variable attenuator value is then decreased in 1dB steps (to increase the sending level) until the tone is raised just sufficiently to trigger the RA equipment detector. This then causes the RA equipment to return a 0dBm 800Hz tone to the outgoing exchange where it can be measured on the test desk Level Measuring Set. The transmission loss of the circuit can now be calculated in both directions by using the information obtained during the test, and by compensating for the switching losses in the test access circuits.

If the circuit is within the specified tolerances, it can be put into service but, if not, any discrepancy should be investigated and corrected as necessary.

The existing manual testing procedure at the outgoing exchange will, in the near future, be automated by the use of Tester 319A. When connected to the circuit under test, the tester will automatically dial the distant RA equipment and then proceed to conduct the transmission tests, giving a display of the circuit losses in each direction of transmission. Issue of the new tester to the field is at present being arranged by TSO 1.2.3.

As the fixed values of the triggering level and oscillator output level of the RA equipment are used to determine the transmission loss of the circuit in both directions, it is essential that they are within specified tolerances – otherwise, circuits may be put into service which are outside transmission limits. These could then cause transmission difficulties, which would have to be investigated and corrected by maintenance staff.

Full details of the procedure are contained in *Technical Information Sheet No 5*, or *Circuit Provision Field Instruction No 3* – both issued by TSO1.2.2 →

Routines important

As already mentioned, many second-generation RA equipments have been found outside the performance limits specified in *TI E6 R5503.*

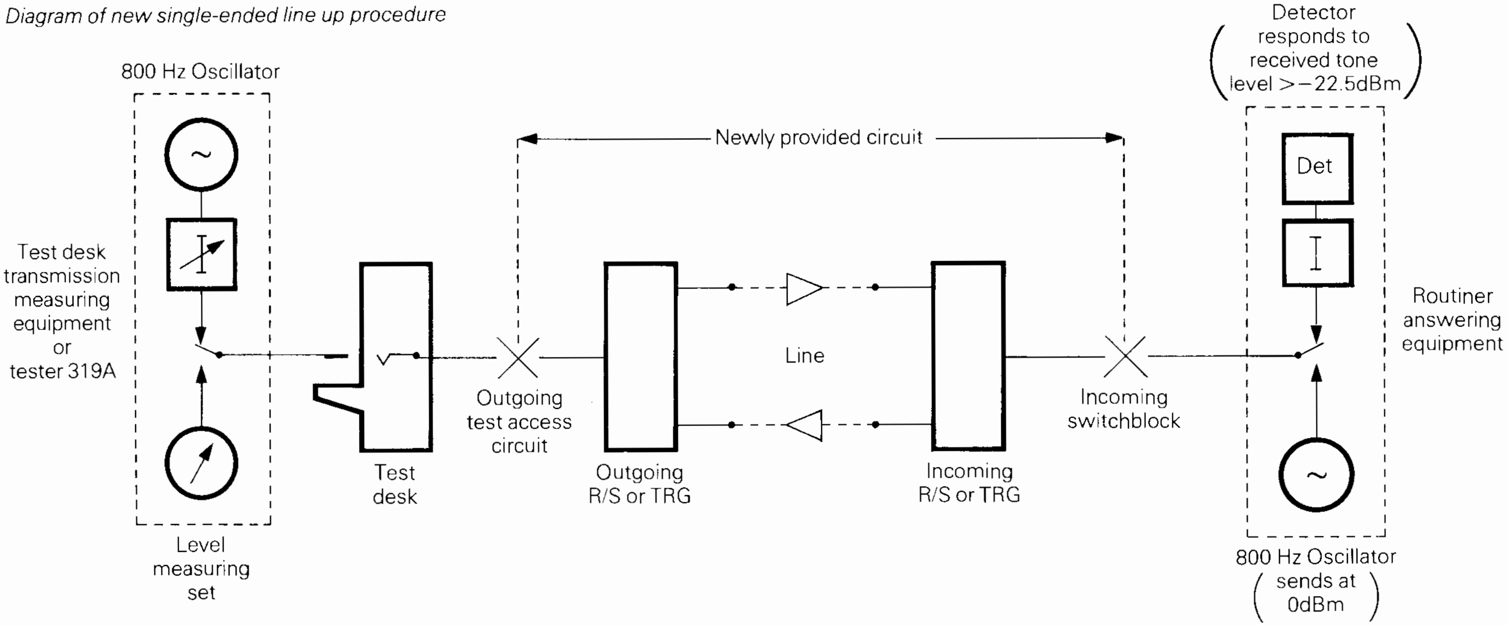
The need to observe strictly the recommended periodicity for routine maintenance – and accurately re-adjust to the specified tolerances – can be appreciated from the new line-up procedure.

New tone receiver

The RA equipment Tone Receiver, AT 61251, has been superseded for new work by a Detector Tone 1A1/AT 61603. Any exchange having difficulty calibrating – or keeping in calibration – old receivers, should change them for new detectors as part of the normal day-to-day maintenance of the equipment.

The tone detector is available from Materials Department, using standard engineering stores requisitioning procedures.
0691 666251 (TSO1.2.3)
01-432 1361 (TSO2.1.1)

Diagram of new single-ended line up procedure



Microfiche documentation for TXE4

by **Ron Webb** LES4.2.1

What are microfiche? Or should it be, what is a microfiche? According to the Concise Oxford Dictionary both are correct, 'microfiche' being both plural and singular. As promised in *MN22* (Spring/Summer 1983) we can now give further information on microfiche documentation for TXE4 exchanges. But first, let me go back to the question.

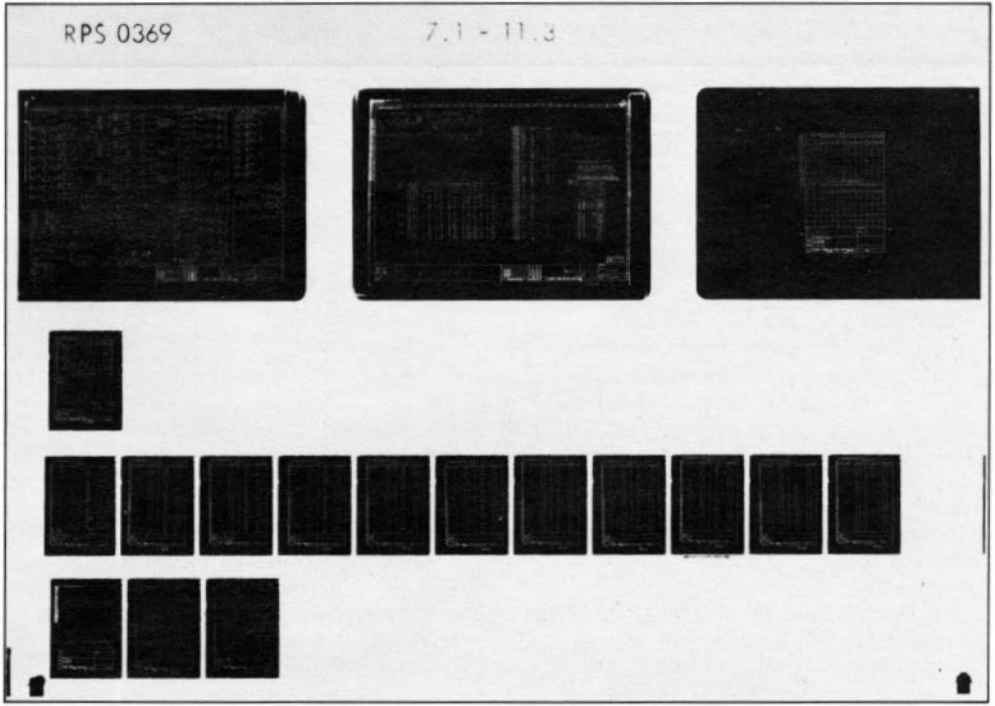
A microfiche is a piece of transparent film (in this particular case 104mm × 148mm) on which are printed, photographically, reduced-size copies of documents. Documents of large original size are reduced to a frame-size of 44mm × 32mm, with six to a microfiche or, for smaller originals, to a frame-size of 15mm × 11mm, 60 to a microfiche. The two frame sizes can be mixed on one microfiche if required, resulting in intermediate quantities. Transfer to microfiche reduces the bulk of TXE4 documents to such an extent that those for TXE4RD, which normally occupy five or six large cupboards, can be housed in a small two-drawer table-top cabinet.

To view microfiche a 'reader' is required, which magnifies the microfiche frame and projects it onto a matt screen, giving an A3-size image that can be viewed in daylight (see photograph).

TXE4 microfiche readers may be either bench-mounted or mounted on trolleys that can also carry a part-set of microfiche documents and an oscilloscope.

Another type of trolley is available for the reader only, that positions it at bench height. *TXE Maintenance Notes RD No 23/83*, and *4A No 60/83* give details of how to use the microfiche documents.

A typical TXE4 Microfiche



Advantages

Apart from space saving – which can be of great value – microfiche has other advantages –

- fiche can be made readily available at the point of activity. For example, on the reader trolley, adjacent to an equipment rack, or in a small cabinet close to the workbench, →

- they can be easily filed at the completion of work, because the file is at the point of activity and not in a remote cupboard,
- fiche are more robust than paper documents so – barring accidents – are unlikely to need replacement,
- they will automatically be updated and distributed to registered files when document changes occur.

Availability

Microfiche are available in 'packages' and should be ordered, on form A344A, from Colin Griffin, Reprographics Unit, RS/U1.5, 211 Old Street, London EC1V 9PS.

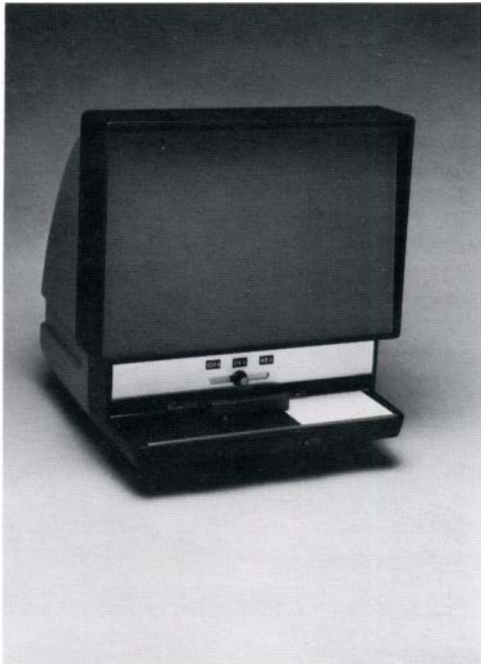
The packages available are –

A – TXE4 RD sites
B – TXE4A sites
C – TXE4A extension to an RD site
D – Complete TXE4RD and TXE4A
E – TXE4RD partial set (for mobile unit)
F – TXE4A partial set (for mobile unit)

An area planning office – with both TXE4RD and TXE4A responsibilities for example – will require 'D' package. For an RD exchange, packages 'A' and 'E' will be required. Any queries about compilation of these files should be addressed to Peter Stebbings, OPS1.1.1, (01-432 3435).

The part-sets (packages 'E' and 'F') contain only those documents most likely to be used in exchanges.

When a single microfiche is required – perhaps to replace a damaged one – it may be ordered using form A344.



TXE4 Microfiche reader

Hardware

The following information will assist in obtaining the 'hardware' for viewing microfiche –

☐ Reader – order on form SD1113, from local office machinery group or stationery office, quoting contract number 598453. The machine is known as the Finlay FC 35/16 microfiche reader and costs £384.

When completed, forms should be sent to Central Services, Materials Dept M7114B, Temple House, 160 Euston Road, LONDON NW1 2DL.

☐ Trolleys – Trolley 8A – for use in the exchange – can carry an oscilloscope and partial set of microfiche in addition to the reader.

Trolley 9A – primarily for use next to a workbench – carries only a reader. Both trolleys may be ordered on form A1063, quoting works order CXE4 21158/3. Send orders to LCSHQ/LES4.2.1, Room 201, 203 High Holborn, LONDON WC1V 7BU.

☐ Storage cabinets – suitable for one file (A or B) only, are obtained by local order from Office Equipment People Ltd., 3-11 Pine Street, LONDON EC1R 0JN (telephone: 01-278 2125). The correct description is '2-drawer microfiche storage cabinet'. (It is important to clearly state 'microfiche' as there is also a card cabinet, which is wider). The cabinet costs £63.45 and there is a 12½ per cent carriage charge.

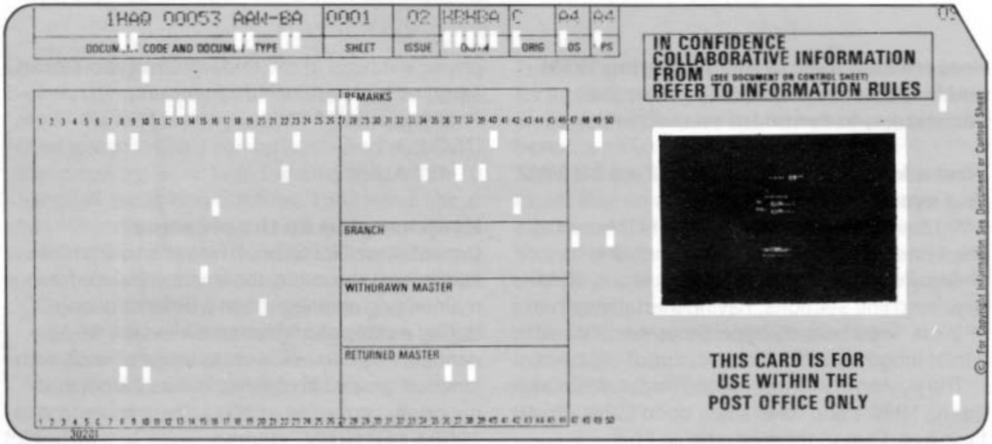
A five-drawer cabinet (type CF5) can be ordered from Microstor Systems Ltd., Roes Maltings, 18 High Street, Baldock, Herts SG7 6AS (telephone: 0462 894646) at a cost of £135. (01-432 2481)

Microfiche at area repair centres

by **Ron Quinney** LES4.2.4

Apart from the microfiche provided for TXE4 exchanges (Ron Webb's article in this issue), documentation is now available on 35/16mm microfiche and 35mm aperture cards for TXD, Monarch, Herald and payphones, and will shortly be available for many other products and systems repaired by area repair centres (ARCs).

Orion Mark 2 Reader-Printer as supplied to Area Repair Centres



Example of aperture card

Documentation in this form saves considerably on accommodation space, and distribution arrangements are simplified. Wherever possible, we intend providing documentation to ARCs either as microfiche or aperture cards. An aperture card is a single 35mm transparency mounted in a rectangular cut-out on a standard 80-column punched card.

As a start, the 10 ARCs with Membrain automatic test systems (described in *MN13*, Spring 1978) have been supplied with the necessary equipment – which differs from that supplied to TXE4 exchanges. The main difference being that ARCs will have an A2 reader with a printing facility. This is essential, so that a paper copy can be obtained immediately for use at the electronic repair bench. Within the next 12 months, all area repair centres will be supplied with a reader/printer of the type illustrated, as soon as accommodation space has been earmarked in the ARC, but priority will be given to those ARCs repairing Monarch units.

(01-432 2806)

On reflection

Here we look back to *MN 13* (Spring 1978) and invite some of the authors, or their successors, to comment on their articles . . .

First a hang-over from *MN 22* on 60 MHZ line systems

MN 12 outlined the new 60 MHz FDM coaxial line systems. The network was installed as shown in that article and consists of ten 60 MHz regulated line sections, having a total length of 953 km. They bear 45 hypergroup sections with a total length of 3757 km.

The systems were accepted into maintenance during 1980/1 and have since been substantially fault-free. Due to the systems' in-built protection switching equipment the few equipment faults that have occurred have had a negligible effect on traffic.

The fault clearance procedure consists of locating a fault to a particular unit and replacing it with a spare. The defective unit is then forwarded to Birmingham area repair centre (ARC) for repair and subsequent return. Spare units have been provided, both in the field and at the ARC.

It has been decided that no more 60 MHz line systems will be provided because of the intention to move to a fully digital network. The spare coaxial tubes in the cables will be used to carry 140 Mbit/s digital coaxial line systems. A modified proprietary system, produced by the main contractor (Philips) for the 60MHz equipment, has been chosen because the physical design of the underground plant is the same as for the 60MHz equipment.

Peter Haynes
(TSO 2.1.1
01-432 1366)

Keep keeping up the pressure

Donald Ansell (LLS 2.6.4) informs us that the field trial of the cable constriction device for maintaining air pressure in a defective length during a cable changeover achieved a 97 per cent success rate on a wide range of local and junction type audio cables. It was introduced nationally on cables of 100 pairs or more in mid-1982 (TI *E3 GO321* refers).

Recent enquiries, however, indicate a mixed reception and usage rate by areas. Some swear by it and use it frequently – to the extent that it is used in every length renewal. Others, though, appear to have reservations on the value of the technique and seldom apply it, if at all – thereby running the risk of losing a cable's capacity during the changeover. A more liberal adoption of the technique is advised, particularly in known, suspect or wet situations, for which it was introduced. An hour or so of preparatory work to fit the cable constriction can –

- avoid unnecessary loss of service and any resultant 'fire brigade' action to restore essential circuits
- help improve fault performance indices and British Telecom's public image.
- safeguard service to customers – more vital than ever in our new competitive environment.

(01-739 3464 Ext 425)

Safety guide RG41

Alan Warman (LLS 5.1) writes: in *MN13* Alastair Campbell opened his article outlining the position on the revision of the safety guide by stating that it would be delayed for some time.

That prophetic remark was five years ago and although Alastair retired last March he did have the satisfaction of seeing published the first of four engineering safety guides which will eventually replace RG41.

Engineering Safety Guide 1 – General Precautions – published in April replaces the general parts of RG41 and a copy should be held by all engineering technical grades and their first line supervisors. Copies of the guide should also be readily available to other engineering supervisors.

In July, *Engineering Safety Guide 4 – Gas Precautions* – was published. This replaces the parts of RG41 dealing with gas, as well as the Propane Plumbing and Gas Precautions handbooks. A copy of this guide should be held by all staff involved with underground work, their immediate supervisors and staff in charge of operational buildings. Other staff may require copies, depending on the history of gas occurrences, and this should be decided locally.

Engineering Safety Guide 2 – Precautions for External Work – was published at the beginning

Letters

of October. This replaces the 'external' parts of RG41 and should be held by engineering staff involved in external work, and their immediate supervisors. Copies of the guide should also be readily available to other engineering supervisors.

The last guide in the series to replace RG41, will be *Engineering Safety Guide 3 – Precautions for Internal Work*. As its title implies, it will replace the 'internal' parts of RG41. Work on this guide has not yet begun but its publication is expected some time in 1984.

The aim with all the guides has been to present information they contain in a readable and interesting form; making wide use of colour, photographs, illustrations and cartoons. From the favourable comments so far received, this approach appears to have been successful. (01-739 3464 x452)

On the carpet

Dick Rawling has something to say . . .

One of the nicest things about *Maintenance News* is that articles can be published without drastic editing. Such was the article by Alan George in the Spring/Summer 1983 issue about under-the-carpet cabling (UCC). Unfortunately, we found some parts of the article misleading, so we offer these further comments on the UCC scene to set the record straight.

As Alan said, the original 50-wire cable failed soon after installation at Leeds.

We do not like the concept of factory-made harnesses, in stock lengths, with the surplus folded up and 'lost' under the carpet. On-site termination of cable was specified and there is now a cable in stock with a different profile from the original illustration. The materials also included a fairly ordinary grade of PVC whereas we are now using quite different plastics and manufacturing techniques. PVC has its place, however, in resisting attack by chemicals and will be used in an adhesive tape 'sandwich'.

Most important is that the cable is not only laid properly, but is also coordinated with the carpet laying. If this is done a good in-service life is assured. The small cable also differs in profile and materials from the illustrations, marrying easily with the round 6-wire and the phone-socket diagrams.

I can also confirm that line jack units 8A and 9A are not being bought at present.

We agree with much of Alan's philosophy. There is a need for UCC, it offers lots of scope for architects, it solves problems, it looks good (in that you don't see it) and it promises lots of benefits to Telecom.

A flat-profile under-carpet power cable also exists that solves the same problem for electricians, and therefore offers even more scope for architects. The problem as to how the two services can cross each other in safety is now being studied.

So UCC may well be the cable of the immediate future. Watch out for it.
(LLC/CE1.4.2
01-357 2827)

On microphonic noise . . .

I must comment on Rob Goundrey's article on microphonic noise in Strowger exchanges – or was it an advertising feature for wipers adjusted to the new standard?

Noise has been a feature of electromechanical switching since its introduction and quite possibly was as unacceptable then as it is now, although the problem is probably worse now than it was 10 years ago. In 1933, six years after the first Director exchange was opened, Telephone and Research branches carried out an investigation into the causes of noise. As a result it was decided to apply petroleum jelly to all selector-bank contacts. The effect on noise was immediate and lasting, but other problems were introduced.

Tests of nickel-silver and phosphor-bronze →

wipers on oiled and dry selector-banks were carried out in 1940. The main conclusions reached were that nickel-silver was the most durable material, that the life of wipers on dry banks was two or three times that of similar wipers on oiled banks and that bank-wiper resistance was lower on oiled banks. As a result, nickel-silver wipers were introduced, although phosphor-bronze wipers could still be found in exchanges as late as 1960, and the banks of 2000-type selectors were not oiled.

When 2000-type selectors were introduced at Rugby in 1936, the banks were cleaned at six-month intervals with chamois-leather. This material was used in preference to velvet because it was more suitable for dry polishing and was not needed to act as a carrier for oil. In some quarters it was thought that the natural oil in chamois provided some measure of lubrication. During the 1950s a power-driven brush was introduced for the normal routine maintenance of banks. This brush was originally developed to remove dust and debris which settled on the banks as a result of bomb damage. A report published in 1956 introduced the idea of using impregnated cotton sleeving fitted to a sickle-shaped tool to remove tarnish and corrosion. Tape, Bank Cleaning Nos 1, 2 and 3 had been conceived, and it was born in 1961. There can be no doubt that this event played a very big part in reducing the number of noisy calls.

A letter appeared in the January 1965 edition of the LTR (now BTL) *Internal Maintenance Bulletin* the first sentence of which read, "After 37 years of automatic telephone switching in London, we do not seem to have progressed at all in respect of the problem raised by high or varying resistance connection between wipers and banks". Harsh words indeed, but the remainder of the letter drew attention to the fact that there appeared to be noisy and noise-free bank contacts, which could be identified by inspection with a microscope or by evidence that certain racks were noisier than others. The material of the noisy contacts had hard and soft domains over the surface, causing uneven wear and resulting in poor electrical contact between wiper and bank. When viewed through a microscope these contacts had the appearance of orange peel.

I believe that during the 1970s we were winning the battle by using Tape, Bank Cleaning Nos 1 (plain cotton), or 2 (abrasive) at six-month intervals, and No 3 (oil impregnated) on those banks which were prone to be noisy. Then block routines were introduced.

Most of us who were involved with the introduction of block routines had misgivings about some aspects of these procedures. Some excellent tests, such as checking for block lift on relays, lack of which could cause noise, were introduced. But bank cleaning at three year intervals, with the penalty of having to do a complete routine if it was carried out more frequently, was ill-advised, to say the least. Yet, Rob says that the present problems are not due to any slippage of maintenance standards.

With regard to wipers, as Rob says, the original adjustment was 12-20 mils. There seemed to have been little wrong with the lower limit, so why not leave it as it was and bring the upper limit down to 16 mils. The thickness of a wiper blade at the point of contact is 8 mils, therefore, if on recheck the gap exceeds 20 mils, the blade is worn for more than half its thickness and will not last another three years, and it should be changed, even if it does pass the tension check. No adjustment of the wiper gap should be made after the first adjustment when the wiper is initially fitted.

In my view, however, the new standard of wiper gap adjustment is of minor importance compared with the problems caused by tarnished or dirty bank contacts and the material from which they are made.

Brian Pearce, BT East
Ex Maintenance
(0206 89464)

Stop Press

Problems with coaxial connectors used on digital equipment
Recent investigations into the quality of digital services have uncovered a very high number of faulty connectors of various types.

Plugs and sockets coaxial No 43/....

These connectors are used on second generation (TEP 1E) digital equipment and problems are being encountered with faulty soldered connections of the centre pins.

'U' links 11A

A design problem with this item (used on 62-type equipment practice) manufactured by SEK (Sealectro, Portsmouth) has resulted in an urgent replacement programme being initiated.

Sockets coaxial 32/....
These connectors are also used in 62-type equipment practice and are still being incorrectly assembled and/or abused in service.

Unaware of these problems?
Consult your TSO2 District Office for information.

Detailed information about the different problems encountered, and their solutions, is in the course of preparation and will be issued to all National Networks districts shortly.

Alan Nightingale
TSO2.1.3.
(01-432 9339)

How do I get that component quickly?
Are you ever faced with the problem of obtaining a component quickly to restore equipment to service only to find it is not available from the usual Telecom sources?

After considerable searching the only possibility open to you is a well-known company used by an ever-increasing number of people – RS Components Ltd.

To provide other sources of supply at competitive prices Central Services Material Department has negotiated 'call-off' contracts with ST&C Electronic Services Ltd and Jermyn Distribution Ltd.

If you are a component user and do not already have copies of Purchasing Bulletins 6 and 8 either contact your area stores control officer (ASCO) or speak to Jerry Smith, the Telecom liaison point, on 0793 484209. Catalogues are available direct from Jermyn and ST&C.

It could be to your advantage and save your Area money.

Derek Lucas
LES4.2.4
(01-432 2815)

If you have a contribution to offer to *Maintenance News* other than a letter to the editor, please forward it to your *Maintenance News* agent listed below. The Editor cannot publish anything to do with current awards suggestions, neither can he be held responsible for technical inaccuracies in authors' submitted text.

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