Maintenance News

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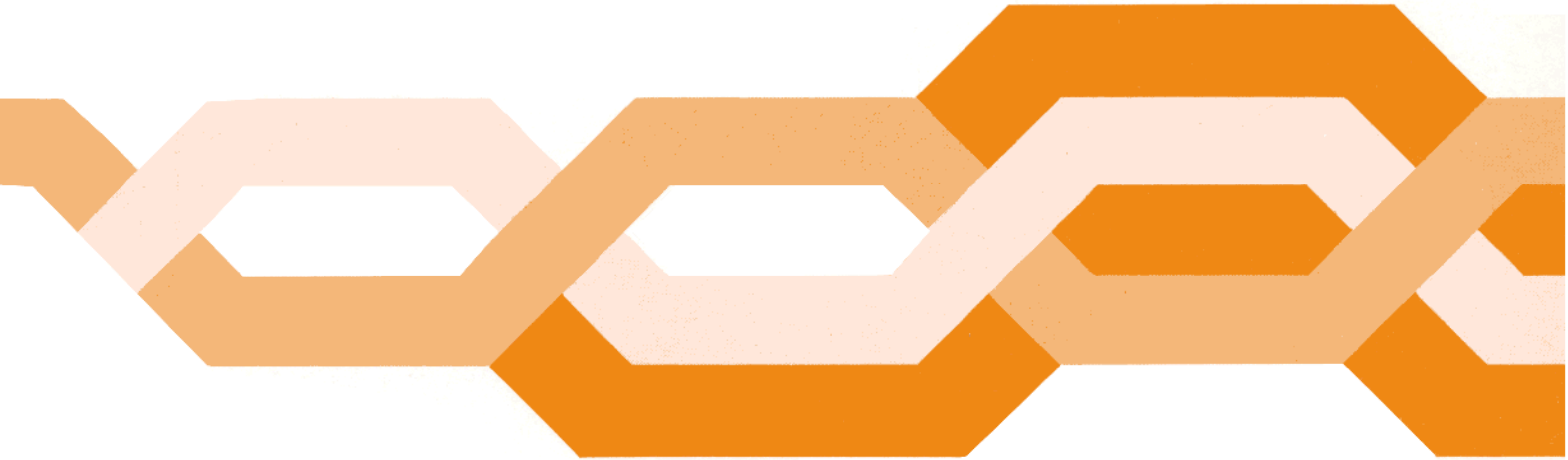

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Maintenance News

Maintenance News aims to provide a medium for two-way communication – that is, between Headquarters and the field. 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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Editorial

The difficulties of keeping completely abreast of all the organisational changes within BT's headquarters are particularly difficult for humble editors like myself who try to keep the *Maintenance News* readership up to date with authors' duty references.

The reasons behind these changes must now be apparent to everyone. If our organisation does not keep pace with the needs of our customers, then we will miss the boat.

It is reassuring to note that, consistently, in all the articles (and letters) published in *Maintenance News*, customer satisfaction – in terms of service improvements and new facilities – is paramount.

Good and efficient maintenance of customer service is our life-line and, hopefully, this magazine will continue to play its part – with your help.

Readers will note that *Maintenance News* is now marked 'For British Telecom staff only.' The reason for this new restriction is to safeguard BT's interests – and yours – in the competitive environment in which we now find ourselves.

– Editor

Harmony loudspeaking unit

by **Tim Keats** BT Merlin/SE1.1.2

The Harmony Loudspeaking Unit (Amplifier & Loudspeaker 12A) is an add-on module giving loudspeaking telephone facilities when used with a handset telephone. It can be used alongside the associated telephone, or mechanically linked to other units in the BT house style – such as the Ambassador telephone and the Herald call-connect system terminals.

Developed from Doric

Harmony is derived from the Loudspeaking Telephone (LST) 8 (Accord) and its operation in loudspeaking mode is identical.

One of the development aims was to obtain a better performance than the LST4. Also it was decided that it would be more cost-effective to use an existing design – if one could be found with suitable performance – rather than developing new loudspeaking circuitry. To this end, a licence was negotiated with Northern Telecom of Canada to use the design of their 'Companion' unit; a limited number of which were already marketed by BT as the 'Doric'. So development effort was concentrated in re-engineering the circuit to fit into an Ambassador style case.

The circuitry is such that only two adjustments are needed during production. One ensures that the output voltage of the power supply is set to 12V, and the other is to balance the send and receive switching levels. It is not intended that these adjustments should be carried out in the field.

Improved operation

To prevent feedback from the loudspeaker to the microphone it is necessary, using present technology, to use voice-switching techniques to allow either the LST user to speak to the distant party or the distant party to speak to the LST user – but not both at the same time.

The direction of transmission is decided by a circuit which continuously monitors the signals received from the microphone and the telephone line. Priority is usually given to the loudest signal if both parties are speaking simultaneously, but after the direction of transmission is selected, a very loud signal in the other direction is required to interrupt the original party, except during pauses in speech. This feature is known as 'switching hysteresis' and is deliberately provided to prevent the unit from continually switching between channels under marginal conditions.

There are two circuit problems with voice-switching LSTs. The first is the time taken to decide the direction of transmission and to switch the unit to that direction. This can result in the first part of a word being lost – known as clipping.

The second is that room noise tends to cause the unit to assume that the noise is a wanted signal and switches into its send direction. The distant party then has to speak very loudly in order to overcome the noise level – due to the hysteresis described – and the LST reverts to the send direction during pauses in the distant party's speech. In extreme cases, the distant end user will be unable to overcome the noise at all.

Harmony attempts to improve these characteristics by using a technique known as 'soft-switching'. The on-off channel switching is carried out by variable attenuators rather than electronic switches as in the LST4. The unit is designed so that there is always 40 dB total attenuation between the microphone and loudspeaker to prevent acoustic feedback. This attenuation is divided between the send and receive channels as required thus enabling the unit to have at least three states of voice switching –

- *Send* – where all the attenuation is in the receive channel
- *Receive* – where all the attenuation is in the send channel
- *Centre* – where the attenuation is equally divided between the send and receive channels.

When neither party is speaking, the unit will be in the centre state. This helps to speed up the unit switching when one of the parties speaks as it is already halfway between the send and receive states. As neither channel is attenuated completely, the first part of the sentence is audible, although at reduced volume.

The room noise problem is improved by special circuitry which discriminates between speech and noise and performs two functions

- If noise is present together with wanted speech at the LST microphone, the unit switches to send, but inserts an extra 10 dB attenuation in the send channel. This reduces the levels of both the noise and the speech sent to line. This may appear to be a disadvantage, but as a user tends to speak loudly in the presence of noise, compensating for the attenuation, the overall effect is to reduce the level of noise sent to line, thus maintaining the level of speech.
- The second feature is that the unit ignores any room noise if there is no speech signal present – so overcoming the second problem previously described.

During the development of Harmony it was felt desirable to avoid the normal BT power units which were large and usually required fixing to a wall. The transformer unit 17A – a plug-mounted transformer providing 20 volts ac nominal at about 250 mA was selected. Connexion to the power unit is by screw terminals which are shrouded for safety on the underside. Protection is provided by a standard replaceable mains fuse and a non-replaceable thermal fuse which operates if the internal temperature rises above 125 degrees C.
(03942 75959 Ext 537)

BTNEs RSIC

by **Walter Kirby** BTNE

BTNEs Regional Service Improvement Centre (RSIC) was the first to be established. It commenced operation in Merton House, Leeds, on January 4th 1982.

As promised in MN20 (Spring/Summer 82) we look at the background to the establishment of RSICs and our problems and progress to date.

The original proposals to establish RSICs in provincial Regions arose several years ago, largely due to the increasing involvement of BTHQ development groups in System X planning. For established systems – Strowger, TXK1, TXE2, TXK3 and so on, there is a continuing need for development effort for service reasons, and for new facilities. It was decided that the best way to meet these continuing needs would be to appoint a Region to be the national authority for development on a particular system. Responsibility for overall network development and facilities would be retained within BTHQ, however.

Broadly, RSICs would have responsibility for –

- Telecom Instructions on system maintenance and routine resting. Defining procedures to assess performance of exchanges, dealing with A646 and Awards cases
- definition of exchange planning and design standards for contract extensions

and direct labour works

- physical and electrical design standards, design and development of systems and sub-systems – in liaison with the appropriate design authority
- drafting and evaluating specifications for direct labour works
- specifying and setting up acceptance testing standards for contract and direct labour works at TXK1 local exchanges and GSCs
- advising Procurement of stores requirements for direct labour works and maintenance
- maintenance of master documentation.

The TXK1 RSIC is a self-contained unit within the BTNE regional headquarters organisation. It has virtually full national responsibility – with the exception of Sector Switching Centres – for the service, development, planning and works functions which were previously spread across several groups in BTHQs Network Executive. The only reservations at the present time are those activities that spread over more than one system – such as signalling and component standards. BTHQ will also retain its responsibility for setting performance criteria.

Before the TXK1 RSIC was set up, support for that exchange system had been severely restricted. Only the most important work was being attempted – mainly limited to hazards and major service problems. Naturally that caused a substantial backlog of work.

The turning point

Just before Christmas 81, all the files, documentation and outstanding work was packed into boxes for shipment to Leeds. The staff chosen by BTNE to operate the RSIC spent some days in London at a seminar and training session. They also talked to the BTHQ groups on development and planning and works, to establish personal contacts – an important aspect – and get a feel for the job.

Early in the New Year, severely hampered by the wintry conditions, all the documentation arrived in Leeds. A vast unpacking and sorting job took place over the following few weeks, but by the end of January the RSIC started doing useful work.

By the end of April, much of the initial sorting of outstanding A646 cases and other maintenance problems had been done and had been reduced to manageable proportions.

Having established the initial priorities for each category of work, it is now possible to devote some effort to the less urgent – nonetheless important – jobs such as TIs and Awards Cases.

After attending to the older outstanding work, the emphasis will shift allowing us to

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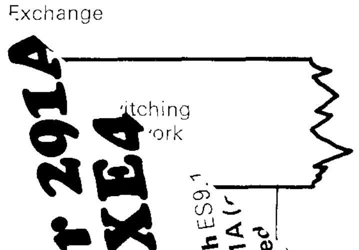
Long-line ahead

TXK1 exchanges – particularly the locals – have a long life ahead of them, and our long-term aim is to ensure that service available to those customers – some 15 per cent of the total at present – is at least as good as that offered by the more modern systems which will be coming into service.

Our general enquiry point is Leeds (0532) 467144.



Tester 291A for TXE4

by Tom French ES9.1
The tester 291A
was developed
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Tester 291A—a network analyser for TXE4 exchanges

by **Tom French** ES9.1.2

The tester 291A (or network analyser) was developed originally by GEC Telecommunications Ltd for commissioning the switching network of a TXE4 exchange. It will be a useful tester for occasional maintenance use, particularly for testing before and soon after exchanges go into service and when unusual faults occur. As the tester is relatively expensive and will not be in constant use in any particular exchange, it has been provided on the basis of one or two for each region to be shared between exchanges.

TXE4 switching network maintenance

'Paths' set up through the network of reed-relay matrices during normal exchange operation are checked for continuity and absence of spurious conditions which could arise from a stuck contact or which could result in a double connection. When a fault is detected, a repeat attempt is made, which endeavours to use a different route through the exchange and a fault message is printed on the exchange fault teleprinter.

But whereas the fault messages identify the terminations, crosspoints and links used on a failed path, they do not pin-point which of those items actually caused a path to fail. To do this it is necessary to compare a number of fault messages to spot a common item, either by manual scrutiny or by computer analysis of punched paper tape (also produced by the fault teleprinter).

Before an exchange goes into service, the switching network will have been commissioned on site by the contractor and subjected to multi-call sample checks as part of the acceptance tests. Due to the size of the switching network these tests cannot be fully comprehensive and faults may have developed since the contractor's commissioning checks were completed. The network can be exercised to some extent by test call senders but again, the level of traffic generated cannot approach the level present at an in-service exchange which is necessary to obtain adequate print-out. Hence there is a risk that some network faults will exist when an exchange goes into service. These faults are not normally intolerable but the period immediately after going into service is usually a busy one for maintenance and COW staff, and the lower the number of faults present at this time the better. The analyser can help here in eliminating network faults.

Once an exchange is in service, the analyser can be of use if faults should arise which cannot be readily located using the normal print-out and maintenance aids. For example : if it is necessary to repeatedly set-up test paths over a selected route, or to exercise areas of the network not subject to high enough levels of live traffic.

Features and use of the analyser

The analyser is able to select a particular path to be set-up between two selected terminations (equipment numbers). Using this feature it can systematically check all crosspoints, inter-switch trunks, and link circuits in specified areas, automatically by sequentially incrementing the indentities of terminations and paths selected. For fault location, particular paths can be continuously selected and the analyser can also make automatic diagnostic tests by selecting patterns of paths around a suspect area to try to identify a common item.

The analyser is software-controlled using a microprocessor. It has a keyboard for inputting instructions and a visual display unit (VDU) and a small printer for giving information to the user. The VDU displays test results, keyed-in data (for confirmation) and other information relating to tests in use. The printer can, if required, give a permanent record of test results.

As the analyser was originally intended for commissioning, the contractor's handbook supplied with it is also intended for this purpose. However, it is expected that some supplementary information will be produced shortly for maintenance use of the analyser. This information will draw on the experience gained by those Regions who have already used the equipment. It has been used in a number of applications. In particular, the

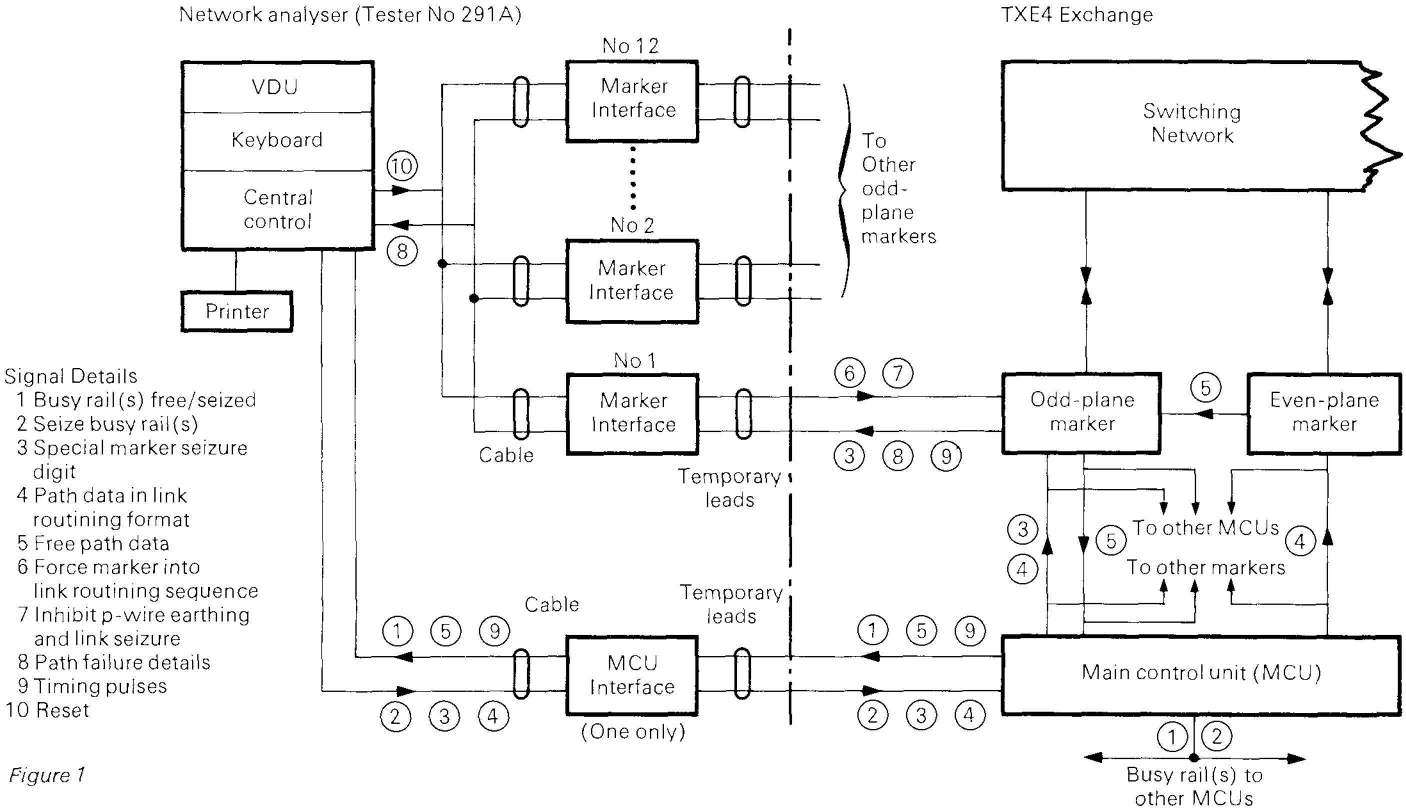


Figure 1

analyser has been found to be of considerable benefit in exchanges which are about to go into service.

Description

As shown in figure 1, the analyser consists basically of –

- a central control unit – this accommodates the VDU and keyboard and has the printer associated with it.
- an MCU Interface
- twelve Marker Interfaces (for ODD-PLANE markers)

The MCU Interface is connected to one of the main control units (MCUs) in the →

exchange by temporary leads. The selected MCU must be busied during the connection of these leads but, on completion, the MCU can function normally to handle live traffic.

This interface allows the analyser to gain access to the Marker-Connector busy rails and to MCU-marker and Marker-MCU highways for the setting-up of test paths.

A Marker Interface is associated with each ODD-PLANE marker (maximum 12) involved with the tests – again by temporary leads.

When the analyser sets up a test path it first seizes the Marker-Connector busy rails (when free) over the MCU Interface, and signals a special seizure digit to the ODD-PLANE markers. This digit is recognised by the Marker Interfaces which force these markers into a LINK ROUTINING sequence. The analyser then sends the remainder of the path data to the markers in standard LINK ROUTINING format to allow a particular link, hence path, to be used.

During the marking sequence, for test paths, the Marker Interface concerned inhibits its ODD-PLANE marker from earthing P-wires, or from finally seizing the link circuit. This feature prevents the test paths which are set-up by the analyser from interfering wirh normal traffic and ensures that these paths will be released immediately after the marking sequence is completed. Should failure of a test path be detected by an ODD-PLANE marker, the associated Marker Interface passes details as to which actual wire incurred the failure directly back to the analyser central control unit for display/print-out.

During normal traffic seizures of markers, the marker interfaces remain inactive so that the markers can function normally.

The MCU Interface and the Marker Interfaces can be remotely situated from the central control unit and are connected to it by cables. The number of marker sets in an exchange (U values) which can be tested together is limited to four in the case of a 6-plane exchange, or to three in the case of an 8-plane exchange, by the fact that a total of 12 marker interfaces are provided. In practice, this will allow a considerable area of switching network to be tested together.

Results so far

Up till now, the major use of this equipment has been in exchanges about to go into service where it has proved to be of considerable benefit.

With increasing use in exchanges already in service, the analyser is expected to contribute significantly to improving the service given by TXE4 exchanges.
(01-432 2213)

SCROLE's roles

by **Noel Davies** TSP4.2.4

Plans are in hand to provide automated traffic measurement facilities at Transit Switching Centres (TSC) within the next year.

This new equipment will remove the need for routine meter reading, and enable traffic records for the transit network to be set up from – and automatically sent on completion to – a central control at Oswestry.

The microprocessor-controlled equipment developed by BTHQ is known as SCROLE (Software Controlled Recording On Line Equipment). It will connect to the existing traffic recorder access equipment, control and meters, [BTHQ will be issuing a works specification to cover this cabling, estimated at between 100-200 BMH per TSC] and will be programmed to start and run the traffic recorder, and produce records equivalent to current A854 records, automatically for up to a year ahead.

Initially it will provide –

- continuous monitoring of register call count meters.
- automatic hourly calculation of Register, and Exchange, percentage factors – currently manually produced on a weekly basis as WPFs – from these readings.
- automatic output of these factors to an exchange-based printer, and to the central control on request.
- automatic control of traffic recording from

the central control, using modem links over PSTN or private circuits.

- preselection of recording periods for up to one year in advance.
- facility to run morning, afternoon and evening time-consistent busy hour (TCBH) records in the same week.
- facility to run a continuous five-hour traffic record with automatic identification of individual route and exchange busy hours.
- automatic identification of average call holding time, grade of service, route and exchange busy hour traffic within the above records.
- automatic production of records equivalent to A854 at the Central Control, and at the exchange, on demand.
- automatic indication of congestion and serious congestion.

Shrewsbury's help

The prototype SCROLE was developed with the assistance of staff at Shrewsbury TSC and has been in use there for two years. Two more prototypes were installed at Bristol and Chester TSCs in October 1982.

The Shrewsbury prototype was demonstrated to Regional Planning Controllers at the Bournemouth Conference 1981 and was mentioned in *Management News* in March 1981.

Queries or requests for further information should be directed to M. Phillips, TSP4.2.4, Brogyntyn Hall, PO Box 7, Oswestry, 0691 54372. Shropshire, SY10 7DB.

Circuit multiplication using TASI 'E'

by **Derek Bardouleau** and **D Palmer**
BT International/IN1.2.1

Circuit Multiplication Equipment (CME) known as TASI (Time Assignment Speech Interpolation) was first used in the UK at Faraday IRS (International Repeater Station) in the late 50's to increase the capacity of the first trans-Atlantic cable TAT 1. In November 1981 TASI 'E', designed by Bell Laboratories and manufactured by Western Electric Co, was installed at Stag Lane IRS to work to a similar terminal at New York's Broadway exchange. This was the first of ten TASI 'E' terminals, three of which are currently in service from Stag Lane, providing additional circuit capacity on the heavily loaded North American routes. The telephone traffic passing over the TASI 'E' systems is obtained from De Havilland and Mollison ISC's (International Switching Centres), both situated within the Stag Lane complex.

CME operation

A number of CME designs by different manufacturers are currently in use, all working on the principle that in any normal conversation there is one talker and one listener at any instant in time. In a 4-wire telephone circuit, this means that on average each direction of transmission is carrying speech for only about half of the time. Natural pauses in conversation further reduce this, so providing sufficient voice channels exist between two CME terminals, the CME can double the number of conversations that can be carried by these channels. This is achieved by interleaving the bursts of conversation in one direction, with bursts from other conversations in the same direction, by means of high-speed switching.

Fig 1 shows a typical circuit multiplication system in which the two directions of transmission are dealt with separately. If A talks to B an idle channel is selected in the direction A-B and a connection is made at both ends so connecting A to B. If A stops talking for longer than a predetermined time, the channel between A and B may be disconnected and assigned to another conversation. If however A then starts to talk again, another free channel will be assigned for this speech and a new connection made. Control channels between the CME's signal the information about the new connection to the distant CME. Thus, during a conversation between A and B, the conversation will be carried by a number of different channels, the number being dependent on the ability of the CME to disconnect immediately on cessation of speech. The more conversations in progress at any one time, the more switching from one channel to another will →

take place. The same process takes place independently in the B-A direction of transmission, idle channels being assigned and connected as required.

TASI 'E'

TASI 'E' has been designed for digital working based on the 1.544 Mbit/s 24-channel PCM in widespread use within the USA. Analogue to digital conversion equipment (known as D4 channel banks) are provided at Stag Lane on the 240 trunk inputs to the TASI and the 120 channel outputs. Figure 2 shows a block diagram of the TASI in which all the functions are realised using digital circuit techniques with major functions being carried out on a time shared basis. The major functional blocks of the TASI are –

- speech and tone detectors, time shared for signal detection.
- two microcomputers for control of the system.
- transmit and receive time slot interchanges for making trunk to channel connections.
- signalling circuits for communication of control signals between the TASI terminals. Three of the 120 channels are used for this purpose and are not available for the transmission of speech.

A 50 millisecond delay is introduced in each direction of transmission to offset the time taken to establish a speech connection through the TASI system – known as processing clip (approximately 26 ms). It also reduces possible speech clipping resulting from more simultaneous demands for channels than there are channels available – known as competitive clipping. This can occur naturally and, for acceptable limits, prevents the number of speech channels from being significantly increased. Loss of channels due to transmission path failures, or a high proportion of continuously active trunks – data calls for example, causing permanent assignment between the trunk and channel – can further increase the chances of competitive clipping by increasing the trunk-to-channel ratio.

When the acceptable level of competitive clipping is exceeded, a dynamic load control signal (DLC) is produced by the TASI 'E' and is used to prevent the establishment of new calls over the trunks until the clipping is reduced to acceptable levels.

Failure of the TASI 'E' system, caused either by a TASI terminal or Inter TASI signalling failure, will result in bypass switching of the first 120 trunks to the 120 channels. Conditions must then be extended to the remaining 120 trunks to prevent the establishment of new calls and to deal satisfactorily with these trunks.

To ensure satisfactory interface between

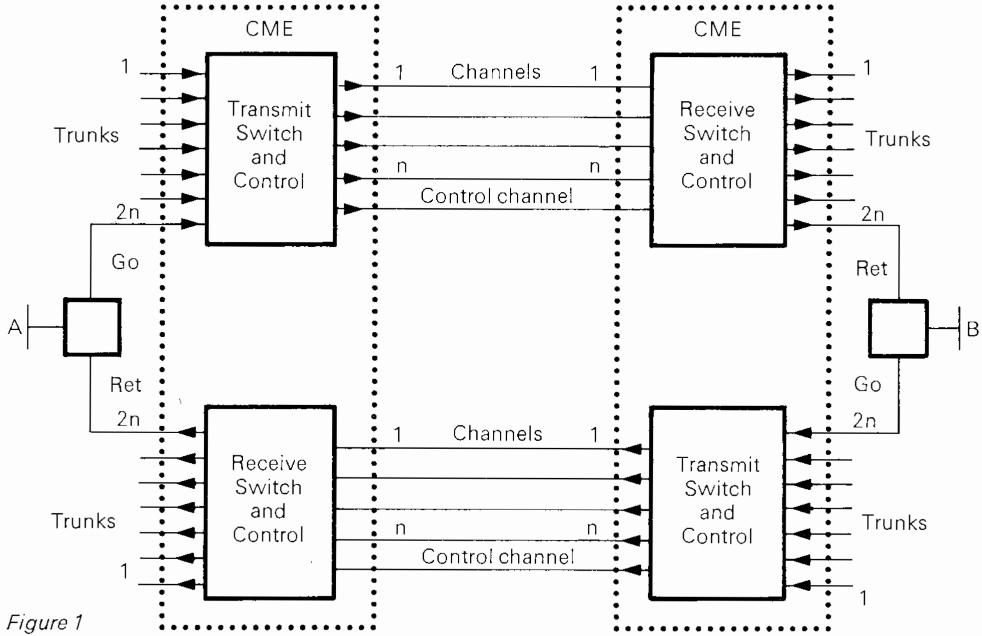


Figure 1

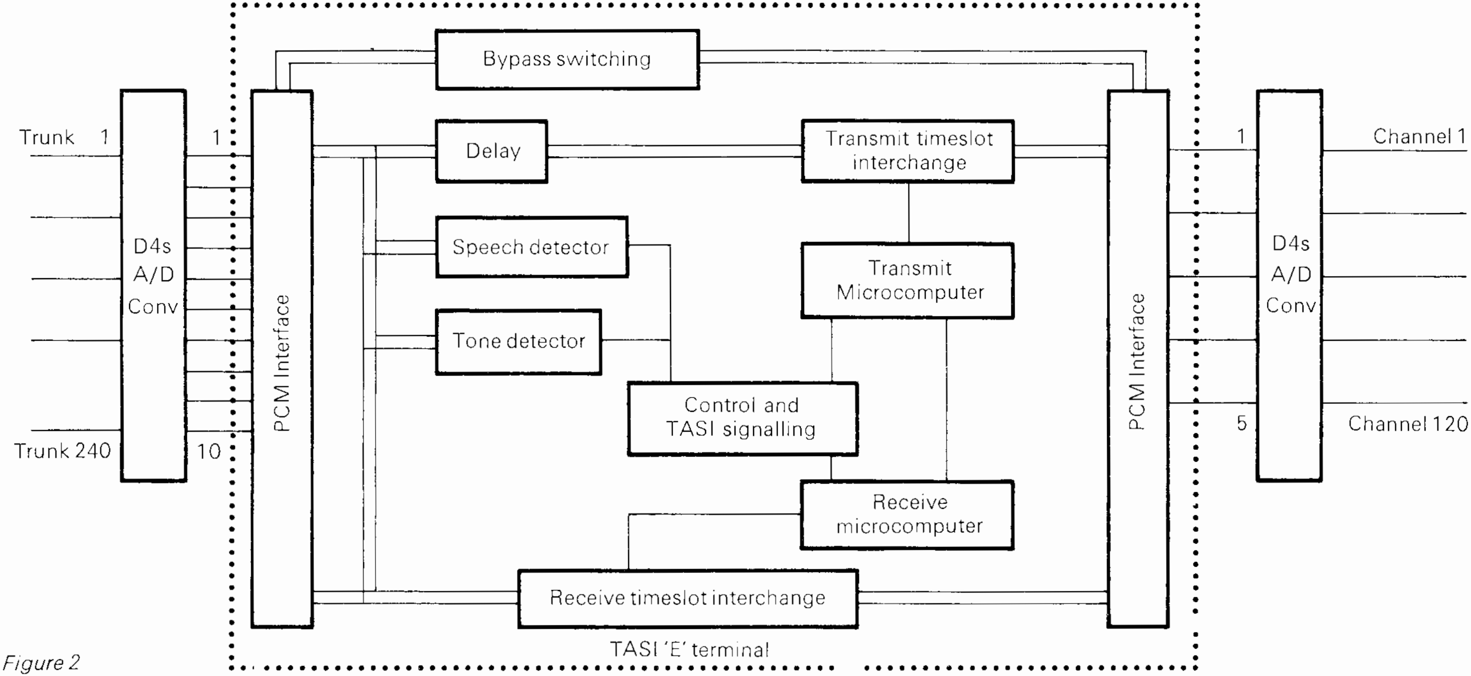


Figure 2

the conditions from the TASI terminal and the ISC, a supervisory system designed within BTI has been installed.

☐ Supervisory system

This automatically ensures that under system failure conditions, removal for maintenance, and 'dynamic load control', the correct actions are taken for minimum disturbance to either new or existing calls. The system can control the TASI circuits from up to five ISCs and can be configured as shown in figure 3. The main features of the system are –

- a control unit interfacing the alarms and control conditions from the TASI and controlling the distribution of signals to the various ISCs. Situated close to the TASI, it provides both a local and remote display of the alarms, the signals and their acknowledgements, enabling rapid diagnosis of any failure to apply the necessary conditions to TASI circuits at the ISCs.
- an interface relay set at each ISC receives the signals and returns acknowledgements to the control unit. It applies the necessary conditions to the TASI circuit terminations at the ISC, displays them to maintenance staff, and permits some conditions to be applied manually in the event of link failure.
- links between the control unit and the interface relay set, of two types. Those for use within DC working limits, and those →

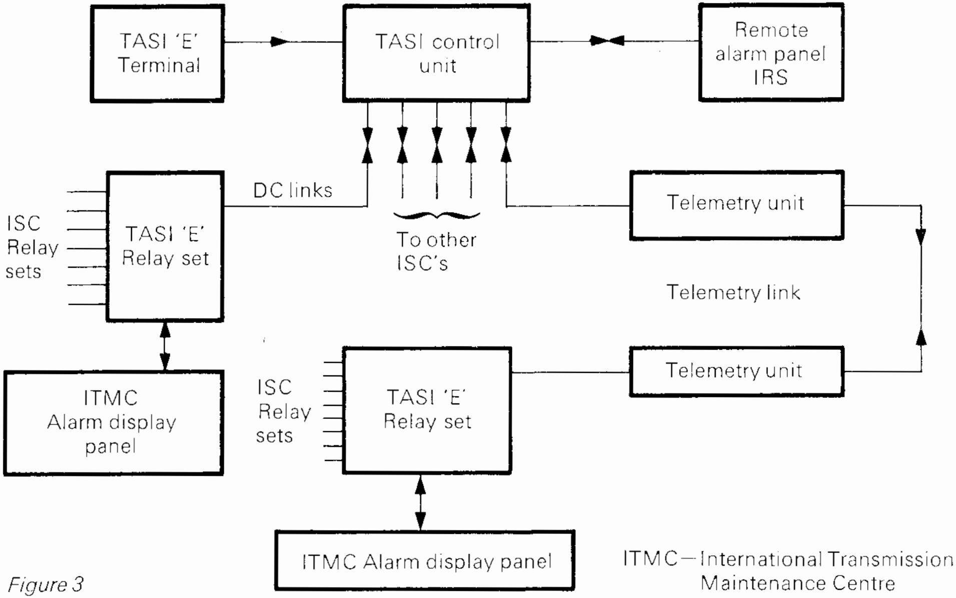


Figure 3

for long distance application using a telemetry system.

For ISCs co-located with the TASI terminal, a trunk processing lead for each TASI trunk is provided from the analogue to digital conversion equipment (D4) to the TASI circuit termination, to block traffic from that circuit in the event of failure of the D4.

TASI maintenance

The TASI 'E' system is provided with a self-diagnostic facility which is run automatically on detection of a system failure. Fault location down to a printed circuit board is indicated by a diagnostic reference number displayed on the TASI. By reference to published data, the faulty board can be identified and changed. In some cases, the indication will suggest a number of alternative boards, and faulting will be on the basis of elimination. Keypad input may be used to request fault reports on a number of alarm scan points within the TASI that are monitored continuously.

The TASI 'E' system also continuously monitors the channels between the TASI terminals by checking –

- gain (variations up to 4 dB can be corrected automatically)
- noise level (for excessive noise on the channel)
- delay on each channel.

A failed channel will be removed from use by the system until further measurements indicate that it can be restored to service.

Keypad input may be used to request system performance reports giving information on the traffic behaviour over a 15 minute period – either the last 15 minute period, or the worst 15 minutes of a given period. Reports on the results of channel checking and TASI signalling channel status can also be obtained. All reports are output on the same readout devices as are used for diagnostic reports.

After some initial problems, TASI is now functioning reliably, with a reducing fault rate nearing the manufacturer's estimate of 3.5 faults per terminal per year.
(01-936 3368)

Maintenance after the monopoly

by **David Memory** ES5.3.3

In issue 19 of *Maintenance News*, Frank Lawson described the twin effects on BT of the 1981 BT Act and Government policy. This article explains how we are reshaping the fault repair service to cope with the changes.

Reduced monopoly

The 1981 BT Act together with the powers it vest in the Department of Industry have had four major effects on the fault repair service :

- Competition in the supply, installation, and maintenance of most types of customers apparatus. This is being introduced over a three year period, simplest equipment coming in first.
- We keep the monopoly on supply and maintenance of the prime instrument, but additional apparatus may be privately supplied and maintained.
- We also keep the monopoly on PABX maintenance except digital SPC PABX which – after July 1983 – may be privately maintained.
- Extension telephones and other types of terminal apparatus may be privately supplied and connected to the PSTN if they are certified. This certification, previously a BT task, is being transferred to independent bodies. When apparatus is offered for sale it must be marked to show whether it is, or is not, certified.

BT business reaction to the change

The customer apparatus market used to be a BT monopoly (except large PBXs) but now we must compete with other organisations. For this to be effective the goods and services we offer to customers must be seen to be comparable or better than those offered by out competitors. But this comparison causes problems since our competitors opt for outright sale, while our traditional services have been tailored to 'subscribers' who pay installation charges and quarterly rentals.

The BT conclusion has been that we too must sell, so we are introducing outright sale as an additional service.

The consequences for the fault repair service are considerable –

- Customers who have bought our equipment are not obliged to accept our maintenance services. So if we want to keep this business then our services will have to be attractive and actively sold. (*Our 'Phonecare' service will feature in a later issue of MN – Editor.*)
- By selling equipment we have legal obligations under the 1979 Sale of Goods Act. Equipment not up to standard must be either repaired free of charge, exchanged for something similar, or the purchase price refunded.
- Any mistakes we make are going to be highlighted. Many customers look on maintenance as *free* because it isn't shown as a separate item on bills. Sold apparatus and, consequently, sold maintenance will change this attitude and make us particularly vulnerable over dubious fault clears, such as repeat faults, RWTs, and FNFs. Furthermore we need an accurate system of customer records so that we are sure of our maintenance obligations.

The introduction of the New Plan fit (now renamed Phonesocket) in the residential market has facilitated the various schemes for selling apparatus and coping with competitors. This will be a mixed blessing for maintenance since it allows all bells in a customer's premises to be disconnected, causing line testing problems and, as a result a probable increase in cases of disputed no reply. But on the other hand the prime instrument policy requires the customer to have at least one BT rented instrument (whether plugged in or not), so simple co-operative testing between the RSC and customer is facilitated. In addition, Phonesocket will also enable us to introduce a scheme for customers to return faulty sold apparatus to 'point-of-sale' rather than call for a maintenance visit.

Results so far

To date the practical consequences from the changes described have been small. This was bound to be, because of the vast size of our rented equipment market and this must →

continue to dominate our efficiency considerations for some time to come. Results from the Phonesocket fit have been favourable. Although introduced over a year ago, the problems we thought may have arisen have not done so.

Changing the fault repair service

Sitting back and simply reacting to the consequences of the monopoly relaxation will not help us to secure our future, so instead we are taking a positive approach to the future of the fault repair service. The main elements of our approach to the market are –

- We have devised – and are introducing – chargeable mantenance schemes for sold customer apparatus. These will be available both by prepayment and 'per occasion' charges. Initially the scheme is aimed at our own equipment, but we are considering opportunities to bid for maintenance of non-BT equipment. A particular problem we face with the introduction of new chargeable schemes is that so many varieties already exist. So we are going to review, simplify, and rationalise our present schemes as well.
- In our review of maintenance services and charges we have included the emergency fault repair service (the 'E' list). This has been used for some years to provide a priority service to customers who wanted it and could qualify for inclusion. We believe this scheme to be outmoded and it is probably outside the spirit of the BT Act since it provides cross subsidisation between the generality of our customers who pay the cost of it, and a select privileged group who receive it free of charge. We are considering replacing the E list by an enhanced repair service which will be available to all. It would provide a range of guaranteed response times to attend to fault reports and be available where Areas have the manpower resources to operate it. But BT will have to continue to meet its social commitments to the community and we aim to do this by a nationally specified policy on repair priority with application left to local Area discretion.
- The introduction of competition has greatly increased the variety of customer apparatus models available. This has reached the stage where a better system of maintenance documentation is necessary. We intend to introduce a series of faultsmen's 'crib sheets' on the basis of one page per product and giving identification details, facilities and services, and field servicing advice. We intend that these sheets should be issued *before* product launch.
- Also, we intend introducing better identification marking on apparatus, which, together with improved RSC procedures, should help minimise double visits.
- In conjunction with all the above, the staffing reorganisation of the fault repair service and the introduction of computer-based systems for RSC administration and line testing equipment as described in this issue, MN 18 and 20, will help provide the resources to support these services.

The Future

BT is entering into a period of extensive change in which it will be rapidly expanding its range of customer services. The customers apparatus repair service must be prepared to corner – and retain – its share of what will increasingly become a competitive market.

The country-wide repair service has the necessary resources and skilled staff. What it now has to demonstrate – in order to successfully beat the competition – is the ability to react to changes in customers' needs.

We believe the schemes outlined in this article will get the repair service off on the right lines to compete for the maintenance of non-monopoly apparatus, but we shall need to monitor their effectiveness and be prepared to make changes where necessary. (01-432 2819)

Alarm handling at Mondial House

by **Stuart Maude** BTI/IN4.2.3

Normal International Repeater Station (IRS) alarm arrangements would have been inadequate at Mondial House because the IRS is split between two floors and is about twice as large as any previous installation. Due to the number of alarms generated a conventional alarm display panel would have been inconveniently large and unduly complex. To overcome these problems a computerised Alarm Handling System (AHS) has been installed to process alarm inputs and display them in the form of an alarm/event list.

The alarms to be monitored fall into four categories –

- group pilot fail alarms
- supergroup pilot fail alarms
- hypergroup pilot fail alarms
- miscellaneous alarms – frequency generating and distribution equipment, line systems, fuse alarms, cable pressurisation alarms and so on.

Alarm point addresses for alarms in the first three categories are linked into, or removed from, hierarchies when groups and supergroups are provided or recovered. Alarms in these categories are analysed such that subordinate alarms are suppressed within the system and only the highest order alarms output. The processor synthesizes higher order alarms from those of a lower order when no physical higher order alarm is available (that is, for hypergroups and national supergroups which do not have pilot fail alarm facilities).

Miscellaneous alarms are not analysed but simply converted to a form suitable for display.

System description

The system is based on a Digital Equipment Corporation (DEC) PDP 11/34 computer with a blend of standard and special purpose peripherals and interfaces. Figure 1 shows the hardware configuration. The system incorporates two working discs which run in parallel, each holding exact copies of the system programs and the alarm database. Should one disc drive fail the system continues to operate using the other disc until the faulty drive is repaired, or the system is patched over onto the standby computer. The alarm interface is capable of handling up to 10000 alarms. It converts the earth condition of an alarm to TTL logic levels (5V) and multiplexes the signals on to a databus to the computer. The computer scans, through the alarm interface, all alarm inputs and records in its memory those that are 'on'. The system software looks for alarms that can be grouped together (those that are linked into a hierarchy) before alarm details are output to colour VDU monitors. A docket may be printed on a special purpose printer for each alarm that is added to the Alarm/Event list. Whenever there is a change to the Alarm/Event list, an audible warning is sounded by the system. The keyboards are purpose designed for this system and are used to edit the system database. They are also used to acknowledge new alarms and call up the various displays on the VDU monitors. A hard copy record of all alarm outputs is available at the system console giving accurate details of all alarms and alarm clears including those of short duration and those of an intermittent nature.

Displays

The operator may select the following displays –

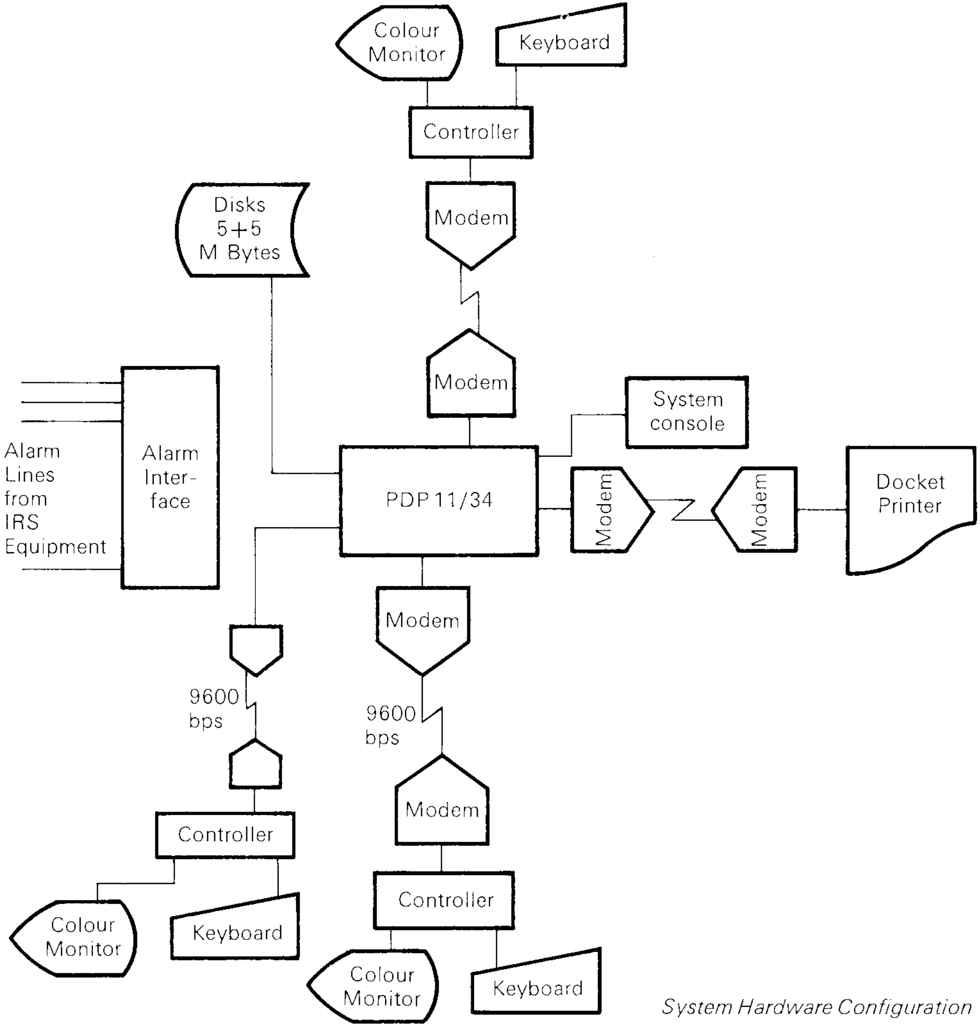
ALARM LIST – current alarms, with new alarms displayed in red and acknowledged alarms displayed in green.

EVENT LIST – as above, plus recently cleared alarms displayed in white.

ALARM POINT SUMMARY – status display of the interrogated alarm point, indicating whether the alarm is 'on' or 'off', whether the point is 'open' or 'closed' to scanning, the designation associated with the point address and its immediate transmission hierarchical relationships.

HIERARCHY DISPLAY – layout of the particular hypergroup to which the interrogated point is linked in terms of the alarm database addresses.

The alarm/event list information for each displayed alarm occurrence is contained in a single line on the VDU monitors. At the time of an alarm being initially output to the →



System Hardware Configuration

monitors this information consists of an alarm serial number, the time and date of the alarm occurrence, the alarm designation and the location of its repeater station appearance. When the alarm is cleared, the time and date of the clear are added to the line.

Operating functions

The facilities provided by the system fall into two sections –

- Normal operation
- Privilege operation

Normal operating functions include the routine scaning of alarm points and the outputting of the various displays mentioned, together with hard copy printouts as mav be required.

Privileged operating functions, which are password protected, allow an operator to modify the database by creating, deleting, editing or linking alarm points.

Data Acquisition

The data acquisition function causes the scanning of all alarm points which have been defined to the system every two-and-a-half seconds. An alarm point must be in a new state for 10 seconds for that new state to be acted on by the system. If the alarm which has changed state is not a member of a hierarchy it will be reported as a change to the alarm/event list and displayed without further delay. In the case of alarm points which are in a hierarchy, the system must wait until any possible related events have occurred.

Hierarchy Evaluation

When a point which is a member of a hierachy changes state, the system records the fact that a change is taking place in the hierarchy and waits for three seconds before examining all the points on the hierarchy. The purpose of this three second delay is to ensure that the minimum number of events are actually reported, while ensuring that unrelated failures are not notified as higher order failures. The mechanism for evaluating a hierarchy at the end of the three seconds is as follows—

- all hardware alarm indications are noted by the system.
- if all the existing groups in any supergroups are alarmed, a derived supergroup alarm condition is declared, unless the supergroup is already alarmed.
- if all the existing supergroups in the hypergroup are alarmed then a derived hypergroup alarm is declared.

Following this evaluation of the hierarchy, the changes to the alarm/event list are generated.

If an alarm point in the hierarchy has changed to an alarm state, then all alarms (if any) relating to subordinate alarm points are deleted from the list.

In case of an alarm clear the entry for the point in the alarm/event list is changed to an alarm clear, and the subordinate members of the hierarchy are examined for any active alarm conditions, which are then reported.

For example, in the event of a supergroup alarm clear, each subordinate group alarm point will be examined to check that they are clear. Any which are not will be displayed.

System alarms

Besides Alarm or Cleared Alarm information resulting from IRS transmission equipment alarms, certain other alarms may occur related to various hardware components, disc drive failure, and interface malfunction in particular. These alarms are treated in exactly the same way as any other miscellaneous (non-hierarchical) alarms in that they are reported as a change to the alarm/event list by the data acquisition function.

Advantages

The AHS allows the IRS maintenance staff to readily identify the highest order alarm source and its station appearance without the necessity to make time-consuming inspections and analysis of a large number of scattered alarm appearances.
(01-936 3230)

Increased dialled access to Eire

by **Noel Davies** TSP4.2.4

Poor service between the UK and the Irish Republic (IR) has caused concern for some years, so in 1980 senior BT and Irish Telecommunications (IT) staff decided that a joint steering group should be set up to co-ordinate improvements in communications between the two Administrations.

One of the proposals accepted by the steering group was a method by which customer dialled access could be increased to 100 per cent.

This article briefly outlines existing access arrangements and goes on to describe the plans for achieving 100 per cent dialled access between the UK and the IR.

Present dialled access UK to IR

- All UK mainland customers have STD access to the Dublin Linked Numbering Area (LNA) and customers in director areas have additional access to six IR provincial LNA's.
- In Northern Ireland all customers have STD access to Dublin and customers on several GSCs have additional access to some IR provincial LNA's.
- To give the present access, a decade of UK NNG substitute codes (00X) was allocated for STD access to the IR. For example, a UK customer dials '0'001 for →

Dublin (IR number group 01) and '0'005 for Waterford (IR number group 051). The actual IR code is unacceptable of course because 051, for example, clashes with the code for Liverpool.

- Each administration keeps the revenue from originating calls – although this method could be changed in the future.

Calls from the UK mainland to the IR have a single tariff rate applied which is between the highest STD and the lowest international rate. Calls from NI are charged at the normal inland STD rates.

- Calls which cannot be dialled are controlled by UK operators at the local AMC. If the call is to an IR manual exchange it is directed to an Irish Service Centre – either Glasgow or Liverpool – except for London director area where calls are connected directly from the local AMC.

Present dialled access from the IR to the UK

- All Irish customers connected to automatic exchanges (about 90 per cent currently) have dialled access to the UK director areas and to Belfast with some additional NI cross border access.
- Irish customers dial an 03X code for the UK director areas and 084 for Belfast's GSC Area followed by any appropriate access digits and the sub's local number.
- Calls from Irish customers connected to manual boards are controlled and set up by Irish Telecom operators and UK gateway GSCs. Calls to UK Non-Director areas from customers connected to automatic exchanges are similarly connected.

Long term plans

The long term plan involves the interconnexion of 2 digital networks themselves interconnected by CCITT 7 signalling. Those outlined here, however, are the short/medium term plans which will result in 100 per cent dialled access prior to the complete implementation of the BT long term plans with which they are fully compatible.

Factors affecting plans for increased access

All plans considered depend on :–

- modernisation of the IR network to eliminate manual boards.
- partial modernization of the BT network. Specifically the provision of five Digital Main Switching Units (DMSU) in the UK mainland and one later in Northern Ireland to serve as gateway exchanges for Irish traffic from UK non-director areas.
- modification to existing International RT and call timing equipment to enable International Number dialled (but not ISC switched) traffic to be routed and charged correctly.
- provision of additional International equipment at some GSCs to cater for Irish traffic.

Some restraining factors were also taken into account –

- Traffic between UK and IR is by far the largest component of international traffic from the UK and would, in the short term, strain international equipment resources. It is also more expensive to switch traffic additionally via ISCs.
- no more UK NNG codes could be made available for switching Irish traffic apart from 10 for temporary use in Northern Ireland.
- it follows, therefore, that traffic to places other than Dublin (and additionally six provincial centres from Director Areas) would have to be International Number Dialled (IND).
- in non director areas IND is technically committed to mf2/AC11 signalling. Only AC9 signalling is common to both administrations and, in the IR, it is only used for routes to and from the UK.
- some sort of mf2/AC11-AC9 interface and collection point for Irish traffic is therefore needed for O/G Irish traffic from ND GSCs. These facilities will only become available with the introduction of DMSUs thus setting the time scale for the completion of full dialled access.
- in the interests of standard dialling procedures the whole of the UK mainland should use the same dialling procedure. Some departure was unavoidable in Northern Ireland.
- only a single charge rate can be applied to IND calls with presently available equipment.

Plans for increased dialled access UK to IR traffic

- In Director Areas existing STD access to Dublin is to be maintained (this is about a third of the total traffic to the IR). Existing STD access to six IR provincial LNA's to be changed to IND (to line up with Non Director Areas) and access to the remainder of the IR to be included by the same means (by dialling 010 353 and the national significant number). Access will be by direct routes to Dublin trunk switching units using AC9 signalling. Charging will continue as existing.

- In Non Director Areas existing STD access to Dublin to remain. Access to the remainder of the IR to be by IND (dialling 010 353 and so on). Acceptance of this code will result in the call being routed, using mf2/AC11 signalling, direct or over the transit network to one of five gateway DMSUs (plus Belfast later for NI). These will recognise the Irish calls and switch them to Dublin Adelaide Road digital unit using AC9 signalling until CCITT 7 signalling is available. From Dublin the calls will be routed onward to their Irish destination. Charging will continue as now. It is planned to introduce this as O/G gateway DMSUs are brought into service. These DMSUs are Birmingham, Cambridge, Edinburgh, Leeds and Manchester.
- In Northern Ireland existing STD access to remain. STD access to be enhanced by the temporary allocation of 10 more UK NNG codes so that all local, and 'a' charge step traffic can be STD dialled with the correct charge applied. The remanent traffic will be International Number dialled and, until Belfast DMSU is in service, this traffic will be routed across to the UK mainland, by means of direct routes or the transit network to Mondial ISC, thence back to Dublin ISC. Charging will be STD rates ('L' and 'a') plus a single (b) rate for the remanent traffic. (*STD access was introduced March '82 and IND access in September '82.*)

IR Traffic to UK

- Existing dialled access to remain to Director Areas (six routes).
- Customers access to non-Director Areas will be provided by means of routes to nine more UK GSCs from Dublin switching units. In this way all but 16 remote GSCs can be reached by a single UK link. To keep within transmission limits the remaining 16 GSCs will be accessed through Mondial ISC and then over the transit network or direct routes from Mondial.
- existing access to Northern Ireland to continue as at present. A direct route from Dublin Adelaide Road crossbar unit to Belfast GSC will provide full access to Northern Ireland.

Financial implications

This article only briefly summarises the salient points of the plans to increase dialled access. Assistance operators will still cater for a proportion of the traffic until all manual boards have been replaced in the IR and the 5 gateway DMSUs are in service in the UK mainland.

Studies show that considerable savings will result when the plans are implemented, mainly due to reduced operator costs. It is also anticipated that it will stimulate Irish-UK traffic, increasing the revenue earned.

Circuit provision

Much circuit provision work has been put in hand to meet the requirements of the scheme, and progress to date has been very good due to the co-operation of all concerned in both Administrations.

Service aspects

It has been agreed by the Steering Group that the service should be provided as soon as possible, if necessary in advance of full circuit and equipment needs being met, although this means possibly risking congestion in order to provide the improved access.

A very important factor in giving this improved service will be the speed with which TMCC staff attend to the reporting, localising and clearing of faults on UK-Dublin circuits, and in restoring them to use as soon as possible.

Some of the improved dialled access will already be available when this article is read. To put the plans into perspective it might be of interest to quote some traffic figures.

At March 83 the forecast total traffic from the UK (including NI) to the IR is estimated as 1175 erlang. Reciprocal traffic being roughly the same.

Two thirds of the total UK-IR traffic was diallable in 1979. When this project is completed in 1983/4 all UK customers will be able to dial 90 per cent of IR customers. Similarly, 90 per cent of IR customers will be able to dial the whole of the UK.

The remaining IR customers unable to dial or be dialled will be those connected to IR manual boards. Current IR plans envisage their complete conversion to full automatic working by 1984/5.

0691 54371

Blackspot analysis — an areas view

by **Mick King** BTM/Peterborough Area M34

What is Black Spot Analysis?

BSA – as black spot analysis is called – has been talked about for some time. In fact, BSA is only part of the story which involves finding fault-prone, unreliable, items of External Plant and bringing them up to modern standards.

That sounds fine! But it can be like finding a needle in a haystack – because before plant can be improved the real culprit has to be found. This is where Black Spot Analysis comes in. With around 210,000 underground (U/G) working circuits in Peterborough Area, and each customer's circuit connected through many cable lengths, joints, jumpers and connections, it is very difficult to identify individual items of plant that are causing disproportionate amounts of trouble for customers.

How is it done?

Information is collected together from three main sources and sifted for clues as to where the plant is causing problems, these are –

- Computer printouts
- Forms A1024
- Dockets A28

●Computer printouts

These consist of LOCAMS and A51 outputs for the identification of high fault-rate exchange areas, and SORT outputs which allow troublesome primary connexion points (PCP) and distribution points (DP) to be pinpointed.

SORT is BTMs computerised analysis of external fault dockets A28 which are completed by field staff when an external fault is cleared. It allows easy identification of plant which is calling out for attention.

But these sources have some short-comings, mainly because they are condensed from more detailed data. So they are supplemented with other information, as follows –

●Form A1024 (Plant requiring attention) – submitted by field staff for all plant they feel would benefit from renewal, even though the incident may have been cleared temporarily. Field staff are encouraged to make the temporary clear as permanent as possible – alleviating the old maintenance problem of attending to temporary clears tomorrow (which never comes!).

●external fault dockets A28 – submitted by field staff are checked as they arrive before filing. Those with common causes – such as wet joints, length renewals, reroutes, aluminium cables in PCP or SCP and so on – are extracted. Checks are then made to see if this plant is already planned for renewal work. This allows obvious problems to be picked up very quickly.

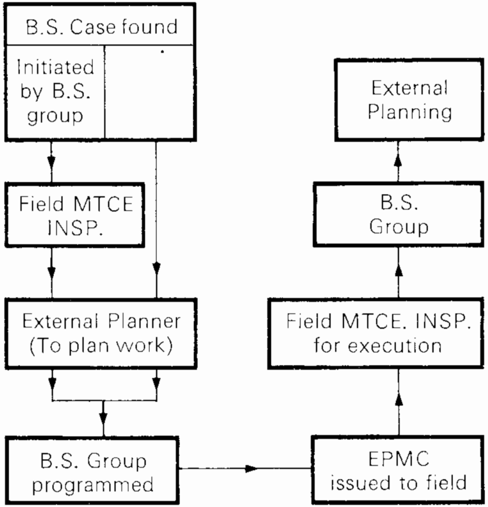
In Peterborough Area a Black Spot Group, operated by an AEE, has been set up to initiate renewal work.

By sifting information, patterns of faults and problems are identified which then allow closer examination. At this stage we rely very heavily on the quality of information sent from field staff. When the Black Spot Group started, 60 per cent of dockets submitted were useless. After visits to each TEC to explain the whole Black Spot procedure – and to stress the point that dockets were the final piece of the 'jig-saw' – the response is now very good. This makes the problem of pin-pointing Black Spot areas very easy.

In addition, we also insist that A1024s are returned to the initiating officer, and this has been particularly welcomed by field staff. So often, in the past, paperwork initiated has never been seen again! Returning them has encouraged the submission of more recommendations. But if it is decided not to take action on a particular recommendation, the case is monitored at regular intervals. It should be noted, though, that from all the A1024s submitted, nearly two-thirds are expanded upon – thus proving their value.

Dealing with Black Spots

When the detective work identifies a possible Black Spot where renewal may help, a detailed study of the plant is made to determine what renewal work is necessary. Once the work has been costed – and shown to be good value for money – the options illustrated in the chart are followed. The reason for two separate routes is that if the case has been initiated by an A1024 the field inspector has already seen proposals, so does not require to see the case again before planning. It can be seen that all people involved with the external network are now involved with this procedure, so it naturally overcomes the age-old problem of 'other' divisions not informing everyone of what is proposed.



It can also be seen from the diagram that although the work is planned by the External Planning division it is executed by the Maintenance division. This is preferred to the work being executed by External Works division, because it gives greater control over priorities for renewal jobs – avoiding renewal work taking second place when there is pressure on provision.

The 'pros and cons'

When the Black Spot group was first set up, the arrangement was viewed with great suspicion by many field inspectors. They felt that their knowledge on 'the patch' was good enough, and had difficulty seeing how someone else sitting in an office, sifting through dockets and printouts, could really help.

But since the whole operation came under one group, errors in computerised data have now been reduced. In general the field staff are now convinced the system is a good one, particularly after visits were arranged for Inspectors, STs and T1s from all field groups to see the Black Spot group at work.

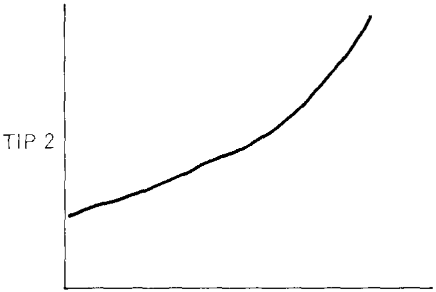
The system acts as a central clearing house for all renewal work, giving the following advantages –

- central control of renewals ensures that the limited resources are used to give the best overall improvement for the customer. Without central control it is very difficult to set priorities for renewal jobs, because no single Inspector has an overall view of the Area.
- the system avoids duplication of work in Maintenance and Works divisions. As a result, better use is made of the money spent, and a more satisfactory engineering solution is finally produced.
- resources are concentrated on work that will give the customer a better service in the long term – rather than the short-term 'cosmetic' job.
- the existence of a central reference point for all fault history information gives an excellent contact point for all groups and divisions – allowing quick comparisons between plant in various parts of the Area.

Against these advantages one small operational problem was highlighted. With all renewals now going through a central procedure, there is some delay before the work is executed. If, in the meantime, a temporary repair fails, the plant may have to be renewed immediately to restore service. A few of these cases initially caused some confusion, but with the development of good liaison between the Black Spot group and field supervisors, the problem has been cured.

Is it worthwhile?

Taking the advantages and disadvantages into account, there are very considerable overall benefits in the scheme. Making the best use of our resources has made a marked improvement to our customer service – both from reduced underground plant fault rate, and speed of fault clearance. These points are brought out clearly in the graphs. In addition, the introduction of BSA has resulted in excellent co-operation from field staff. The need to explain the changes to all staff involved cannot be over-emphasised. →



Once everyone clearly understood what was intended, they were all extremely helpful and determined to play their part in improving plant for our customers' benefit.

It would be wrong to suggest that it is easy to install an effective Black Spot scheme. Hard work and dedication by those involved has produced a very good scheme in Peterborough Area, but only by persistent efforts – and convincing others that it is the right thing to do.

Now that the scheme is working well, Peterborough Area's customers will reap the benefits for years to come.

Peterborough (0733) 59634

An approach to improved transit performance

—(Incoming register translator (type 10) AT 60223)

by **Ted Lindfield** and **Roger French,** BTSE/SM1.1.1

When monitoring calls on the transit network using the 2760 signal analyser we found that most failures were occurring in the destination GSC – usually no 'terminal proceed to send' or 'number received' – indicating failures in the incoming register translator (RT).

During investigation, a number of difficulties came to light which are listed below with the action taken to date within BTSE. Considerable improvement has resulted in our incoming transit performance as measured by MAC(MS8). All incoming international traffic also routes via incoming RTs, underlining the importance of this equipment.

Alarms

In many GSCs incoming RTs are situated remote from the outgoing transit equipment, thus alarms may be dealt with by staff not fully conversant with the equipment. Also, all alarms are 'deferred', which may create the impression that they are of little importance.

Three types of alarm are provided – 'Send Fail', 'Receive Fail', and 'Second Fail'. Send and Receive failures always indicate a failure within the incoming RT. But second failures may be RT failures, although in most cases they are due to network problems or customers' errors. This often causes a loss of confidence in the alarms, particularly as no information is stored indicating the digits dialled or the origin of the call. So no useful action can be taken.

Most causes of Second failures due to conditions outside the incoming RT, are 'Incorrect C Digits' or '20-40 Second Time-Outs'.

Incorrect C digits

This condition is normally caused by faults in the originating GSC or in the destination TSC. It is extremely rare for it to be caused by faults in the RT. As the origin of the call is not known there is little advantage in generating an alarm in this situation. In BTSE we have connected all spare C digits to the CO lead, allowing the RT to release without alarm. The call will still 'repeat attempt', so degradation of service will not occur.

20-40 second time-out

This occurs due to non-receipt of a digit and is normally caused by insufficient digits received. Exceptionally, it can be caused by an incorrect or disconnected number length strap giving too long a number length, but this should be found when routine testing.

A race between the time-outs in the controlling register and the incoming RT always exists. The calling customer receives

NU tone (when the Controlling Register times out), but the incoming RT will only alarm if it times-out *before* the controlling register. Again, insufficient information is stored to enable the problem to be identified.

A design fault also exists such that if a Send or Receive Fail alarm occurs between the S & Z pulse, a send/receive alarm changes to a Second Fail when the Z pulse is received. So we consider there is little advantage in alarming the 20-40 second time-out, it being better to release the RT and allow the Controlling Register to force release the call every time.

Alarm faulting aid

This aid has been produced to assist in identifying the cause of alarms without detailed reference to diagrams and diagram notes. It is particularly useful to staff who have to deal with alarms when not fully conversant with the incoming RT or transit signalling in general. By checking the state of relays in the sequence shown on the chart the probable cause of the failure is indicated.

The chart can conveniently be displayed on the rack in a grading chart holder.

Copies of the Alarm Faulting Aid together with details of the alarm modifications can be obtained from BTSE SM1.1.1 telephone 0273 201245.

□ 1st fail meters

A meter is provided for each Incoming RT. As no critical figures are available the readings are often not acted upon.

It should be checked weekly that similar increases are obtained on all incoming RTs. A higher reading on one RT suggests a fault may exist. Lower readings indicate that it has been out of service.

Nil readings should always be investigated. It could mean that, due to a fault condition, the RT cannot be accessed. Thus if all registers lock out on second fail, automatic reset will not take place and isolation will occur.

Typical readings should show an increase of 30-50 per week dependant on the ratio of incoming circuits to RTs. Variations between RTs should not exceed ten per cent.

□ Type 10 relays

This comb-operated relay can produce intermittent faults due to wear on the comb, causing buffer springs to lift with the comb. The problem appears more prone on spring piles with 4-6 springs rather than a fully loaded spring pile of 10. If intermittent faults are occurring, type 10 relay springsets in the relevant part of the circuit should be examined.

3000 type relays are available to replace RS and SE type 10 relays. TI *E5 H0112* paragraph 13 refers.

□ Type 4 uniselectors

Type 4 uniselectors are responsible for a high proportion of incoming RT failures. In most cases they hunt for a marked outlet rather than respond to pulsing, this makes correct adjustment even more important. A common error is incorrect wiper positioning. The trailing edge of the wiper should be positioned on the first third of the contact, not between the first and second thirds as in the case for Type 2 uniselectors. TI *E6 H5111* paragraph 18 refers.

□ Equipment fault log

Most regions have introduced a fault log for the incoming RT. It has proved invaluable in identifying patterns of the more elusive intermittent faults which are bound to occur from time to time. We recommend its use.

Maintenance routine instructions (MRIs)

MRIs applicable to the equipment are –

R849 – Functional Test (*Weekly*) *using TRT118*

R849 – General Tests (*4 Weekly*) *using TRT118*

R944 – Block Routine (*yearly*)

Due to difficulties originating exchanges have in identifying problems caused by distant incoming RTs, it is important that functional tests are carried out at the recommended periodicity.

Tracing transit failures to destination exchanges is time-consuming and often frustrating. We are confident that time so spent can be considerably reduced if attention is given to the points discussed in this article at all GSCs, and considerable improvements in overall transit performance will result.

0273 201245

New Printout analysis for TXE4 (RD) – PATE 4

by **Peter Jones** IDHQ/ES9.1.2

A new system of Fault Printout (FPO) analysis has been developed for TXE4(RD) exchanges. This system is called PATE 4 and is proving to be an extremely effective aid to fault finding in TXE4(RD) exchanges. This type of analysis uses a small business computer (SBC) to analyse large amounts of FPO that would be difficult and time consuming to do manually.

The existing system of batch analysis was developed primarily to find reed failures. But as the TXE4(RD) reeds have proved to be very reliable, there are few faults for the costly batch analysis system to find, so the cost of each fault found has been high. Also, experience has shown that a more comprehensive analysis of the large amounts of data contained in the FPO would be of great benefit to maintenance staff. A project was therefore sponsored with a Management Service and Science group to investigate an alternative method of FPO analysis. The outcome was the analysis program package run on an SBC, called PATE 4. Batch analysis is still used – though not as frequently as before – to identify switching network faults.

The PATE 4 System

The PATE 4 system consists of the following hardware –

- SBC (processor and floppy disk drive combined)
- punched paper tape reader
- visual display unit (VDU)
- tape winder
- line printer.

Each region has been provided with a PATE 4 package consisting of handbook and master program disks. Secondary masters are made and distributed by the regions as required. Data disks are also needed. One double-sided, single-density disk can store data from a maximum of six FPO tapes. Each tape contains up to 1000 lines of FPO.

When the SBC reset button is pressed, a PATE 4 message greets the user, giving the options available, much like the Prestel system. This is known as a menu. For example, on first using the system, the 'input a tape' option (option 1) on the function menu is selected. On typing a '1', the next set of options – giving checks on the connection of the equipment – is displayed.

A 'HELP' option is available for each menu, and return to the Function Menu is easily achieved by pressing the reset button.

Data on the punched tape is converted by the tape reader from 5-unit Murray code into a form recognised by the computer (8-bit ASCII). When it has been loaded, a 'CONVERT' option is selected. This automatically displays each line of print as it is placed in an appropriate file, such as MCU, Switching Network, Other etc.

When the whole tape has been 'CONVERTED' the printer produces a listing giving a count of Equipment Numbers (ENs) that exceed a certain threshold, also a matrix showing Fault Codes (FCs) against Sequence Location Numbers (SLNs). When the printing is complete the options are displayed. The user then requires an extensive knowledge of TXE4(RD) to get the best out of the system; driving it to 'home in' on faults. The recommended approach is to note the ENs that have exceeded the threshold for immediate or later investigation. They may then be supressed from the analysis so that they do not mask other faults. The next step is to select the analysis program to work on Switching Unit/Plane/Link Type data, looking for high link counts. These should be printed for later investigation and then suppressed. A 'D' switch analysis should then be performed to highlight 'D' matrix faults or EVEN planes that need CROSSPOINT analysis. Again, when faults have been identified and printed, they should be suppressed. The SLN/FC matrix should then be analysed to find the remaining faults. Early investigations inevitably result in some FNFs. This can be discouraging, but apparently fruitless investigations are vital for subsequent analyses where hidden faults will eventually be found. It is important therefore to keep good records of all investigations, no matter how useless they may first appear. These records are also needed by other staff so that they do not repeat the work that somebody else has done.

The PATE 4 system is only required at those exchanges where high levels of FPO have become a problem. When PATE 4 has been used at such exchanges the FPO should have reduced to a level where manual analysis can be effective. It is envisaged that only one or two systems will be required per region. Ideally, expertise will be built up at such exchanges and staff from other exchanges should make use of this when using PATE 4 on their own FPO. Some regions however have exchanges that are geographically far apart and therefore have to site their SBC system in regional HQ. Tapes will then have to be posted to RHQ for analysis.

The importance of FPO

The amount of FPO an exchange produces is a very good indication of how well an exchange is performing. Of course large city exchanges are likely to produce more FPO than small rural exchanges so the number of effective calls made before a line of FPO is produced is a good way of comparing different size exchanges. Two types of figure are used. For a good exchange they should be as follows:
1000 effective calls per line of print (switching network only)
800 effective calls per line of print (all print)

The effectiveness of PATE 4 was amply demonstrated at a busy London exchange. Before the use of PATE 4 the number of effective calls per line of FPO (switched network only) was about one hundred. After the introduction of PATE 4, the exchange staff achieved a figure of 1000 and occasionally a remarkable 1500! What happened at that exchange was that maintenance effort was organized around the FPO. The dramatic drop in FPO needed a lot of effort and tenacity but was clearly worthwhile. The use of PATE 4 requires a shift in emphasis from conventional maintenance thinking that tends to leave the FPO to last. The FPO should become the focus of maintenance attention. When faults are tackled in this way using PATE 4 and the recommended figures are achieved, then other exchange performance indicators will have also improved. This means far less written complaints together with good TSO and MAC figures.

The future

PATE 4 has been very well received and feedback from the field indicates that only 'fine tuning' is required. The PATE 4 system is being developed for TXE4A which is likely to use magnetic tape as the storage medium instead of punched paper tape for FPO. Other facilities under consideration include: night routiner FPO analysis, local docket analysis, exchange performance indicators, storage and validation of records. These developments offer the possibility of taking the more tedious work away from exchange staff and give them more time to do what they are good at – finding faults.

The PATE 4 system of FPO analysis is an excellent maintenance aid and has already proved its worth. When properly used by staff with good TXE4(RD) system knowledge, exchange performance can be significantly improved and FPO levels reduced to a manageable size.
(01-432 2457)

Special service managers

by **David Kennard** SSE 133

Over the past two years, a new type of job has been formalised within each Area, and now has an important role in the maintenance of special services. The new job, which can be either part-time or full-time for an AEE (depending on the Area's work-load) is known as the Special Services Manager (SSM).

In his recent article on special services maintenance (*MN Spring/Summer 82*), Don Beckley of T5 (now TSO2) referred briefly to the new job and its role. The need for it came about because of the unusual nature of a large proportion of special services, in that they use a wide range of plant throughout the local, junction and trunk networks – often requiring specialised tests to commission and maintain them in service. Customers have often complained of the difficulty in finding someone who can answer for poor performance on long-distance, high-grade services, such as amplified private circuits. Also, because of the various boundaries of responsibilities for various plant in the existing networks, there is difficulty in progressing and clearing faults on these long-distance circuits quickly enough to satisfy our customers.

Essentially then, the new job for the SSM is to oversee the engineering aspects of service performance for special services within the Area, and to co-ordinate any action which may be needed to improve their maintenance. To do this, he may need to consult with other managers, both within and outside the Area, who will be responsible for the normal maintenance of Area plant.

More specifically, part of the SSM's job may be to control the operation of one or more Special Service Control Centres (SSCCs), which are being set up to concentrate the work of several private circuit fault reporting points (FRPs). These SSCCs will give the customer a point of expertise for reporting faults on his special circuits. In some localities, the SSM may also control field staff who clear faults, or provide technical support for special services.

Because of the wide range of plant required for special services, the SSM will be a contact point, not only for other managers within the Area, but for other SSMs in other Areas. Naturally, the SSM can co-ordinate restoration work on long-duration faults, and can be involved with those faults which are escalated for technical or managerial support. For long-distance faults, the SSM can call on further support from a special-service liaison officer in the Regional HQ (RSSLO) and at the National HQ (NSSLO).

Another task for the SSM is to monitor the maintenance performance of private circuits, which primarily is measured as TIP2A – the percentage of private-circuit fault reports which are cleared by the end of the next working day. Over the last two years, the TIP2A achievement has increased nationally from 64 per cent to 82 per cent, which is a promising start to future improvements. Perhaps of more relevance to some customers, the average outage (or out-of-service time) of private circuits has reduced over the same period from 20 hours to 15 hours, while the fault rate has remained constant at about 0.5 faults/circuit/year. However, when comparing these results with those of some overseas administrations, there is still room for improvement.

Looking into the future, making further improvements will not be an easy task, and there are no easy solutions. But concentrated teamwork can produce a better maintenance performance for special services, and the SSM will be a key member of the team.
(01-432 9148)

Network improvement using MAC

by **Brian Sapsford** ES9.3

Measurement and Analysis Centres (MACs) are now working in all 61 telephone areas and 17 Areas are now TIP targeted on their MAC results. In April 1983 all Areas will be TIP targeted on MAC results.

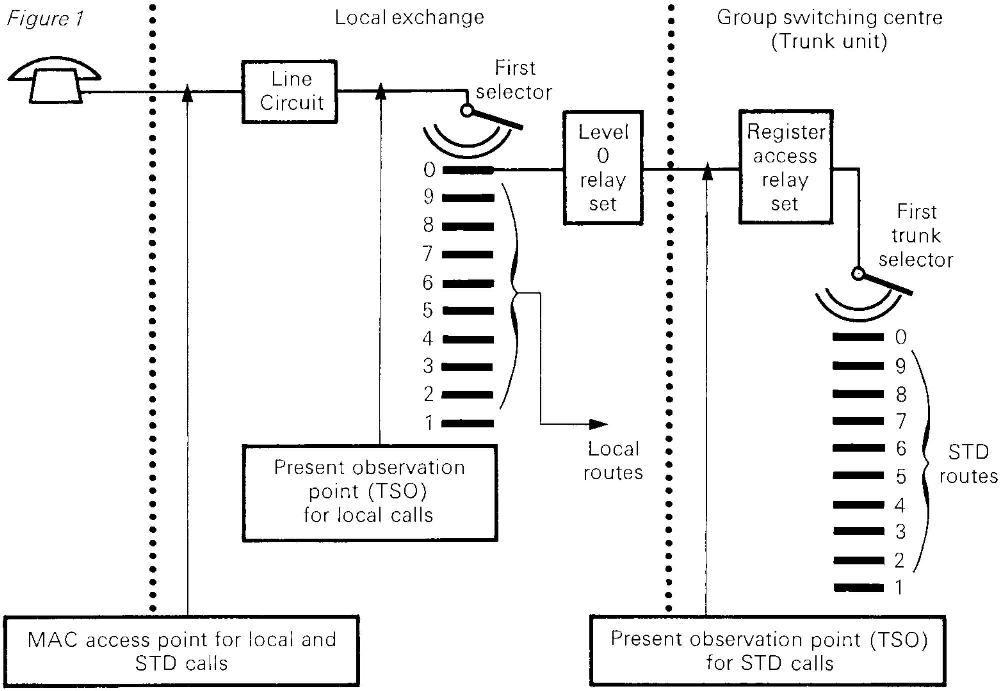
TIPS (Telephone Improvement Plans) are used by BT managers to exercise control over the quality of service of the inland switched network. Each year BTHQ, Regional and Area managers agree TIP targets that should be achieved in the coming 12 months. The two TIPS that have, in the past, been used to control the inland switched network are TIP 3 (local automatic service) and TIP 4 (STD service). Each TIP indicates the percentage of calls that fail within the network due to plant defects or congestion.

From the mid-1950s TIP 3 and TIP 4 results – based upon the results obtained by Telephone Service Observations (TSO) – have been used to manage the network. The access points in the exchanges used to observe the customers calls for TSO purposes are shown in Figure 1 together with the access points in the network MAC uses.

MAC Measurement

The MAC system is not only capable of assessing the service given by the network to our customers on an overall basis, but also of assessing the service of different sections of the network by running what – in MAC terms – are called measurement sequences. Two main sequences – MS2 and MS3 – assess the performance of the local dial area and STD services respectively. Other sequences, such as MS1 (own exchange) and MS4 (GSC access), may be used to identify problems within the other two sequences, and clearance of faults located by MS1 and MS4 is essentially under individual exchange control. It was decided that, in order to manage the network, a series of TIPs based on the MAC measurement sequences would be required. So TIPs 52 and 53 have been allocated to the local dial area (MS2) and STD (MS3) results. →

Figure 1



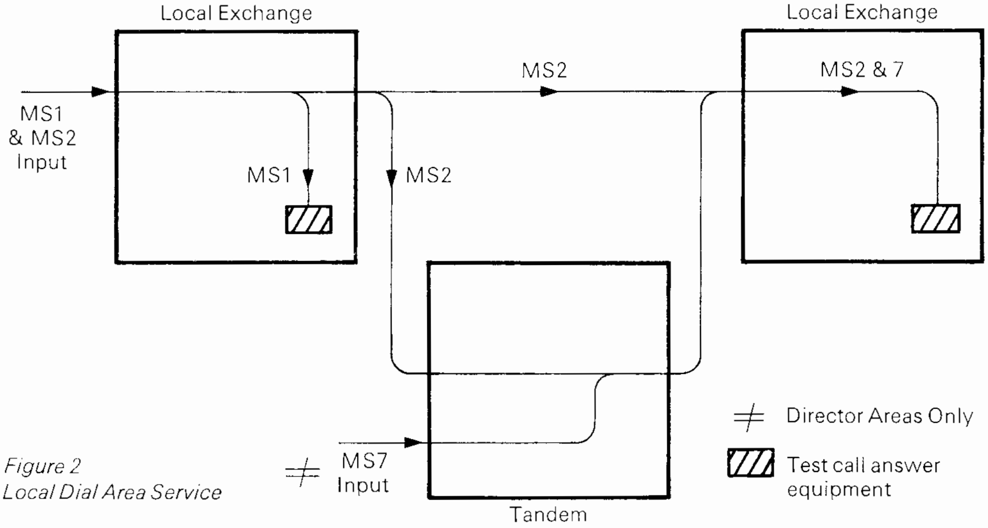


Figure 2
Local Dial Area Service

Local Area Service

Figure 2 indicates the routes taken by the test calls in the various measurement sequences which have a direct effect on the service given in the local dial area. It is evident that attention must be given to MS1 in order that improvement can be made to the overall local dial area performance. In director areas additional assistance is given by running MS7 which injects test calls at the director tandem exchanges and routing them to dependent local exchanges.

STD Service

Figure 3 indicates the measurement sequences which sub-divide the STD network and perform the overall measurement of the STD service. Again, attention to the results obtained in the various measurement sequences will enable overall improvement to be obtained in the STD service.

Overall Improvement to the Service

Local managers – as well as Area and Regional managers – now have at their disposal information which can identify poor exchange and route performances. Targeting these measurement sequences in a structured manner will enable units and Areas to improve the service given by the network to our customers.

For the future, targets and achievement based on the measurement sequences of MAC will play an ever increasing role in the service offered to our customers.
(01-432 2059)

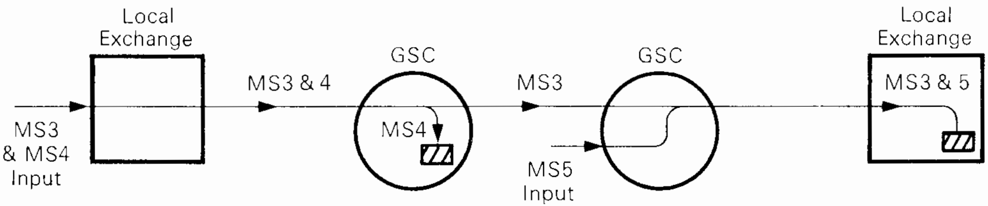


Figure 3 STD Service

Modernising repair service controls using computers

ARSCC(E) by **John Gore** ES 5.1.2
ARSCC(D) by **Les Roberts** ES 5.1.5

In *Maintenance News* 18 (Spring 81) Denis Webb wrote about the new strategy for the fault repair service. Part of this involved the use of a minicomputer to improve the management and day-to-day running of the Repair Service Controls (RSC). It will mean a virtual elimination of paperwork previously needed for fault report processing – and benefits in management information and control.

Administration of Repair Service Controls by Computer (ARSCC) is the name given to this scheme, and there are two versions, ARSCC(E) – for 'electronic', and ARSCC(D) – for 'docket', both shown in the diagram, Figure 1.

First, John Gore introduces the ARSCC(E) system, in which visual display units (VDU) provide all RSC functions –

- access to customer permanent information (CPI)
- customer fault history (CFH)
- fault report records (FRR)

Workloads are presented to the appropriate RSC duty in the form of lists from which work is selected in accordance with locally-decided priorities. Field officers' workloads are built up by means of 'work lists' of preallocated and issued FRRs. FRRs, once raised, cannot get lost.

Besides the normal RSC functions of reception, testing, distribution, records and supervision, ARSCC(E) also supports outstation functions such as External Plant Maintenance Controls (EPMC) and customer service divisions. Future developments will include –

- links with remote line testing (RLT) systems (see MN20 page 17)
- special circuit fault reporting system (CAMSS)
- multiple use of the ARSCC(E) minicomputer by more than one RSC.

Facility outline

☐ ***Reception.***
On receiving a fault report, the reception officer enters the customer's number into the VDU keyboard and is presented with a display of customer permanent information and a list of outstanding fault reports, if any. A recent fault history is available on request. The reception duty enters the fault report in coded form and then allocates the FRR to a test or distribution duty – or to an outstation – depending on the nature of the fault. Estimates of fault clearance periods (commitment times) are available on screen to pass on to the customer, if required, and appointments for visits can be made and entered.

The FRR is then transferred from the reception duty's hold list to the appropriate function group list for further attention. It remains live on the FRR file until a valid clear is entered. If the reception (or any other) duty tries to abandon a FRR prematurely it is referred to the supervisor.

☐ ***Test.***
The test function carries out diagnostic testing to establish the nature and location of faults. ARSCC(E) presents the testing officer with his workload in the form of test group list of FRRs. These will normally have been allocated by reception officers but supervisors and distribution officers are also able to do so. Testing officers may also raise new FRRs. When test results have been determined, the testing officer raises the full FRR format, enters details on the FRR screen and reallocates it to the next function for further processing, generally to a distribution group list.

☐ ***Distribution.***
The distribution duty liaises with field staff in the issue and clearance of fault reports. The distribution function workload is presented by means of distribution group lists. A group may consist of one or more FDOs (fault distribution officers). Lists will generally contain sufficient information about the FRR for issue to a faultsman without the need to display the full FRR. →

Modernisation of repair service controls

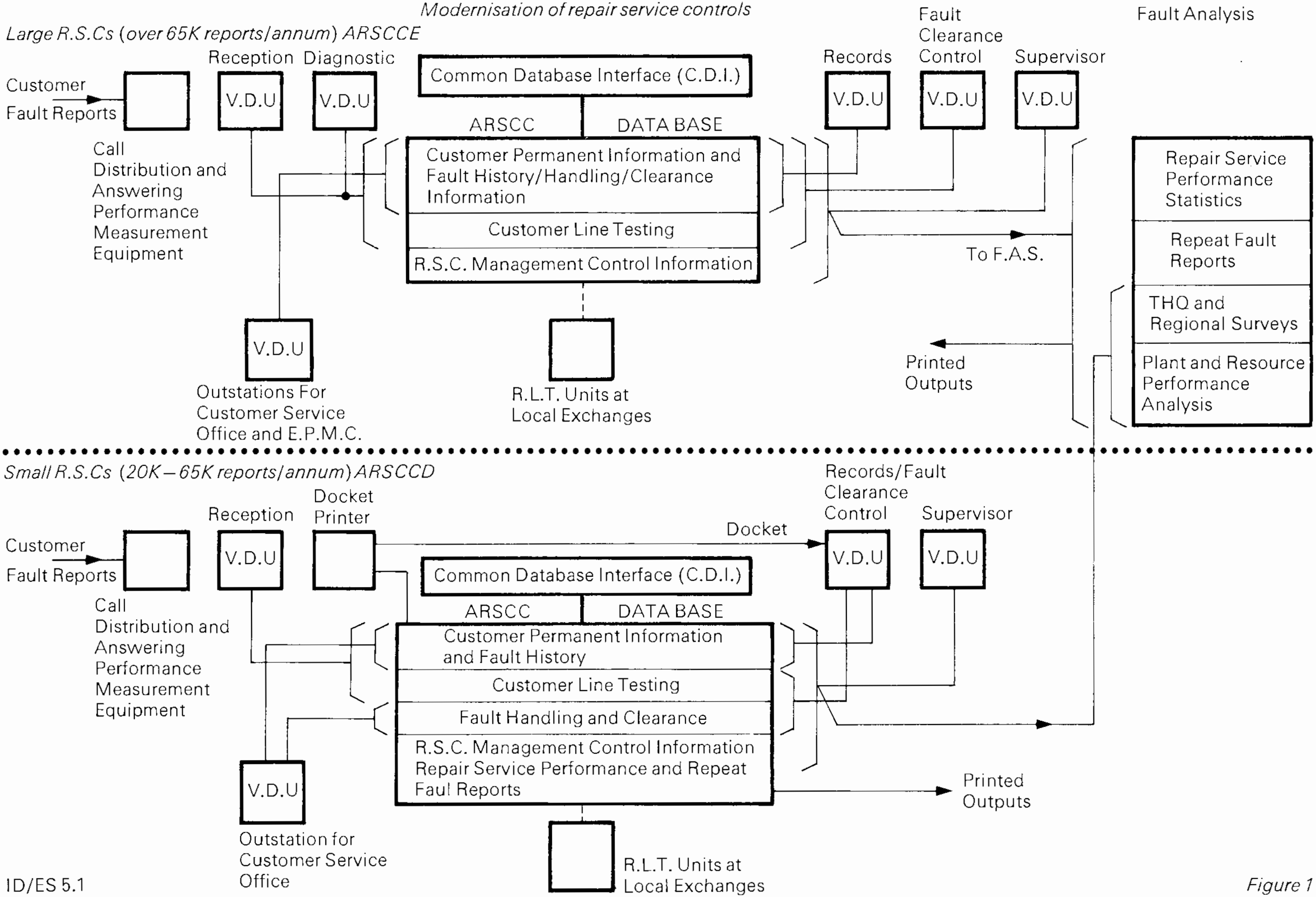


Figure 1

Entries are automatically grouped in priority number order – related to the class of service – but FRRs may be dealt with in any desired order. A facility is available, under the control of the RSC manager, to extract FRRs having particular attributes from the group list to form sub-lists. For example, for E faults, PABX only faults, or faults in a particular exchange area.

Each field faultsman is represented on the system by a work list into which the distribution duty enters FRRs which have been allocated to him for attention. It is thus equivalent to a pigeon hole.

Distribution officers may pre-allocate FRRs in order to prepare a batch of work prior to formal issue. The normal restriction on distribution officers barring them from processing FRRs from other group's lists may be overridden by the RSC manager.

To clear a FRR, the distribution officer (or other duty) must enter a valid clear code and the identity of the person who has advised the customer of the clear. The FRR is then removed from the in-hand file and used to update the CFH.

□ ***Records.***
The records duty is responsible for updating the CPI file from advice notes, engineering change advices and so on. A series of commands are available to initiate new entries and changes to individual CPIs. When large-scale changes are needed – exchange number range for example – these can be performed by entry of a simple sequence of commands.

□ ***Supervision.***
The supervision function is split into two levels, S1 and S2. The S1 user has facilities for helping reception, test and distribution officers handle more difficult cases. He can also recommend reorganization of the RSC to meet operational needs.

The S2 user is able – by means of control parameters – to reconfigure the RSC organization, to authorise access to the system, to set up work lists, to modify fault clearance commitment times and so on.

A 56-Type desk modified to take ARSCC terminals

All-round benefits

This article has given a very brief description of the main functions offered by ARSCC(E). Many more commands than those mentioned are available to cover the full range of RSC requirements. HELP and INFormation screens are available on request at all stages to assist users who are not fully conversant with the system. Printouts of displayed information and statistics can be ordered as required.

The overall result is aimed at improving →

RSC working efficiency and RCO job satisfaction. Customer perception of service should be enhanced by awareness of improved speed of answer and fault clearance performance, and by staff displaying the extra confidence that possession of firm and reliable information on fault clearance prospects will bring.
01-432 2879

Now, Les Roberts introduces ARSCC(D).

ARSCC (D) system has been developed for use in Repair Service Controls (RSCs) where the report rate is below a nominal 65000 reports/annum.

It can be set up in RSCs where the report rate is higher, as a stop-gap until ARSCC (E) is installed.

ARSCC (D) is a mini-computer based system using the same family of computer hardware as the ARSCC (E) system, but the number of VDUs may or may not match the number of work stations. This depends on whether it is modular or test desk and on the existing layout and accommodation of the RSC. It will provide access from all VDU work stations to customer permanent information (CPI), current in hand fault information, the fault report record (FRR), and customer fault history (CFH). The fault handling process within the RSC is carried out by means of a transaction document (fault card/docket) printed by the system at the time the customer report is accepted.

During the subsequent progress of the report through the RSC, the FRR can be amended in association with the docket to give details of the current position eg to which duty or field staff the fault has been distributed. The system provides local management with either on-demand, or regular information, to monitor the performance of the RSC and field operations. Remote access is also provided for customer service division, interrogation, and operation.

Future enhancements will include links with the remote line testing system (RLT), the advice note computer system for the update of CPI records and to other RSCs within an Area for the transfer of customer reports out-of-hours. An outline of the system is shown in figure 1.

System operation

The system is 'menu' driven using the VDU and has been designed for basic RSC operations, such as reception, test, distribution, and records. Any RSC work station can carry out any of these activities on entry of a predetermined code or password. All RSC staff can carry out any particular function except those designated to the supervisor.

Now for a brief description of these activities –

□ ***Reception***

On receipt of a report, the reception officer inputs the customer's number, and the system responds with a display of the CPI and details of any outstanding faults on that number.

The reception officer accepts the report if the complaint has not been reported previously and is awaiting attention, and the customer's report details are entered onto the system. Details of any tests made or fault localisation can also be entered at this stage. On completion of these tasks the system outputs the fault report docket. A typical docket is shown in figure 2.

Figure 2

□ ***Distribution***

The docket is then passed to the fault distribution officer (FDO) who may carry out more detailed testing before allocating to customer apparatus field staff or specialist maintenance groups. The FDO can either enter this information onto the system from a VDU or enter it in manuscript onto the fault docket. On completion of the report, details of fault clear are input to the system, including any handling details not previously entered.

☐ ***Customer Permanent Information (Records)***
Changes or additions to the CPI can be made from any work station at any time. However regular advice note tasks will be carried out either by CSO or a specific record duty.

☐ ***Background Tasks (Lists)***
Listing of current fault handling operations and historical data are carried out by a second 'menu' available to all RSC staff, and includes –

In-hand fault position with list for RSC, Exchange Area, or functional groupings
In-hand faults indicating days out-of-service (escalation procedure)
A29 breakdown
Appointments
Outstanding maintenance
Repeat faults

☐ ***Supervisor Functions***
A separate 'menu' under the control of the supervisor, provides facilities for the day-to-day control of RSC operations. Typical functions are, oversight of user passwords, setting of control parameters, for example repeat fault limits, amendments to exchange code and number ranges, and access to fault history database for analysis purposes.

Benefits
Although the ARSCC 'D' system does not process fault handling by electronic means – as with the ARSCC 'E' system – the ability to retrieve CPI and fault history instantaneously is of considerable benefit. It also has the benefit of the fault analysis system (FAS).

It enables RSCOs to respond to customer's reports quickly – especially where an 'in-hand' fault already exists.

It gives the RSC manager the ability to monitor the day-to-day operation of the RSC more effectively, and the effect of any administration changes more rapidly than collecting data by time-consuming manual methods. The system also benefits other groups in an area. For example the customer service division will be able to respond to customer telephone complaints immediately by interrogation of the customer's fault history, without having to contact RSC staff.
(01-432 2888)

Letters

.... Lock the stable door first!
I refer to the article on International Leased Circuits (ILCs) by Geoff Blaxall, (International RSSLO), Issue 16 *MN* Page 9.

Now that we have entered the era of competition with such enterprises as Project Mercury, some of the questions posed in his article take on more importance. Bearing in mind that we are no longer a monopoly and must strive to give the best possible service to our customers, we must make sure that our house is in order.

May I therefore draw attention to some of the points raised in Geoff's article. For example –

- Are your records up to date?
- Can they be easily found by the emergency man when called out?
- Are all tags soldered?
- Is a Case 200 (or equivalent) fitted to each ILC?

We have much evidence to prove this is not so, particularly in some LTR Areas, where the majority of our circuits terminate.

The mean time-to-restore figure for 1981 – where circuits were faulty due to local area problems – was 22.8 hours. This compares with a figure of 8.7 hours for faults cleared at the overseas distant end, and 6.7 hours for faults attributable to International Transmission Networks under the control of the UK.

Don't lock the door after the horse (or customer) has bolted. If our customers are →

not satisfied, they will move their hub of communication elsewhere.
Vic Robbins International SSM/IAS
Mondial House (01-621 5509)
Thanks Vic. One day – the sooner the better – the message may sink in – Editor.

. . . from an author

On reading the last copy of your excellent publication in which my article 'Improvement Plan for the overhead network' was published, it occurred to me that you had been a little over zealous in exercising your editorial licence. I would like to point out that the original text used the word **regulation** in the context of tensioning open wires with ratchet and tongs. So if you have had any letters from indignant field staff I would appreciate it if you could put the record straight.
John Stoddart BTSWHQ/SV1.3.2
0272 295240
The point John makes deserves an apology from us. Just how the word ***work*** *came to be printed instead of* ***regulation*** *I cannot say. Field staff had every right to express their indignation, but judging from the silence, they could not have felt too strongly about it – Editor.*

. . . for 'accept' read 'take' into maintenance

The letter from John Vidler in the 1982 Spring/Summer edition of *Maintenance News* raises the issue of 'maintenance acceptance'. The word 'accept' is inappropriate to the transfer of equipment from works groups to service divisions because Works Groups have the responsibility, on behalf of BT, to accept equipment from contractors and the responsibility to commission direct labour equipment installations.

The A346 procedure informs the Service Divisions that work is complete and the estimate is about to be closed, it is not intended to be a document that initiates a retest of the equipment. The Maintenance AEE and staff should have had sufficient awareness during the equipment installation period ro have drawn the attention of any shortcomings to the appropriate person.

No one would deny maintenance staffs the opportunity to familiarise themselves with equipment, but the approach has not always been conducive to harmonious relationships between groups. So please delete 'accept' and insert 'take into maintenance'.
Jim Sharp
BTSE Transmission Eqpt Planning and Works
PL/L1.2 (Brighton (0273) 201265)
The editor comments – I suppose English, in common with many other languages, can too easily cause feelings to be roused especially when the offending words are seen in print. Without wishing to open a debate on the subject of 'maintenance acceptance', I have known many instances where poor installation practices in customers' premises have left maintenance staff 'holding the baby' when faults are reported under operational conditions. There is an onus on both Works Groups and Maintenance Groups to liaise as closely as possible – as early as possible – to avoid the often elementary causes of problems that give rise to service complaints later on. Whether one prefers 'accept' or 'take' the sentiments should be interpreted in the right spirit by all concerned – otherwise we shall lose another valuable customer! Vic Ribbon's letter brings out this message better than I can.

Dave Bull of Cricklewood ATE writes about a fault he found during a joint test with an IBM 1750 switchboard from 11/– Final Selectors.

Fault

Cut off on all even lines incoming.

Symptoms

D relay releases in any F/S under test.

Fault

Short-circuit or earthed line wipers (in this case HB) on F/S.

Cause

When the faulty F/S line wipers pass over the line contacts of a circuit with an established call, it is cut off by the IBM 1750.

This is due to the fast scan rate (6.6 milliseconds) of the IBM 1750 detecting a degrading of the conditions on the line of an established call – treating it as a caller-clear condition thus releasing D relay in the F/S under test.

This will occur whether the faulty F/S is hunting or releasing over the contacts.
BTHQ's PABX group commented that although Dave has drawn attention to a particular problem experienced with that IBM 1750, it could be experienced also with other types of Stored Program Control PABXs on TXS exchanges, although it was stressed that there was no evidence of this. Dave's letter may help others – Editor.

New announcer for SALT

The Equipment Announcer 6B

by **Terry Smith,** ES5.4.3

Since the introduction of announcing machines in the early 1930's, BTs verbal recorded announcements have used a mixture of electrical and mechanical technology. Many recording media have been used over the years such as photographic contained between two layers of glass, iron oxide sprayed onto a non-ferrous drum, magnetically loaded neoprene bands, and ordinary recording tape. Existing electromagnetic methods are to be replaced by modern technology.

The equipment announcer No 6A (EA6A) – developed for use on the Subscribers Apparatus and Line Test Equipment (SALT) – is a 12 magnetic track replay only announcer, each announcement lasting for 2 seconds. A mains-driven aluminium drum, sprayed with iron oxide, forms the recording medium. The replay heads are mounted close to the surface of the drum and produce a very low amplitude signal which is amplified at the SALT rack before being fed to line.

New technique

The reliability of the EA6A had given cause for concern for a number of years so new designs of Announcer using modern technology were studied. Various methods of providing announcements were looked at using both electrical and mechanical technology. Because the required message duration was short and fixed content, digital storage techniques could be used. A general specification was issued inviting tenders from manufacturers, and TMC Limited offered a prototype for approval. This item was eventually approved, coded as Equipment Announcer No 6B (EA6B), and a quantity purchased.

The messages are stored on Erasable Programmable Read Only Memories (EPROM). A technique of Adaptive Delta Modulation (ADM) is used to store and 'replay' the spoken words, using a sampling rate of 32 kilobits per second.

Before explaining the EA6B in more detail, an introduction to Delta and Adaptive Delta modulation is included.

Delta modulation (DM)

A delta modulator uses the amplitude information in an analogue signal to code a stream of pulses at its output. These pulses are equally spaced, of equal width and amplitude.

Figure 1 shows that the output consists of a series of either positive pulses (indicated as 1) or no pulse (indicated as 0) which are passed through an integrator, resulting in a staircase waveform. A step upwards or downwards is produced for every pulse.

The delta modulator compares the amplitude of the staircase waveform (B) with the amplitude of the input analogue signal (A) which is to be coded. It is the sign difference that is coded, not the magnitude. If the difference is positive a pulse is generated causing the integrated value of the signal to rise by one quantizing unit. If the difference is negative no pulse is sent, so the integrator reacts by reducing the coded signal by one unit. The staircase waveform produced by the integrator therefore follows ►

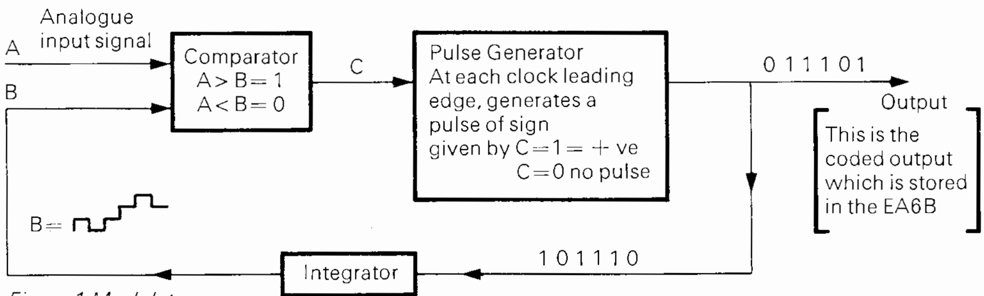


Figure 1 Modulator

the analogue input signal. Figure 2 illustrates this.

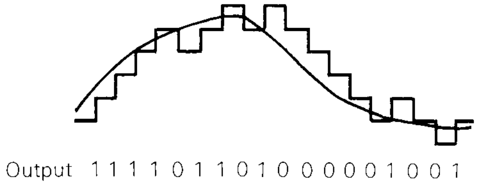


Figure 2 Showing how output of integrator (B) responds to presence (1) and absence (0) of signal pulses at coded output.

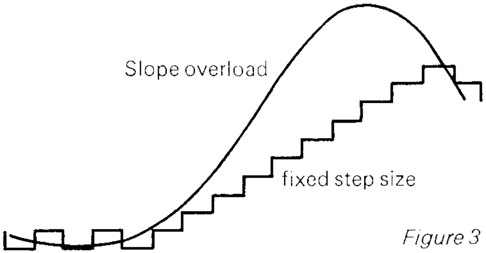


Figure 3

Distortion

One of the problems with using a fixed step size is that distortion other than the usual 'quantizing' noise can arise. This is shown in Figure 3. If the analogue signal amplitude rises more rapidly than the integrator staircase waveform it is possible for the comparator to decide that output pulses should be sent continuously over a period of time. Thus the coded signal will fall behind the analogue signal. This is called 'slope overload' and the resulting quantizing error is referred to as slope overload distortion. The step size also determines the error when the slope is very small or no input signal is present. The output will then be an alternating sequence of 0's and 1's. This type of quantizing error is called granular noise. For these reasons a large step size is needed to accommodate rapidly-changing signals, while a small step size is needed for low level signals. To cater for these needs Adaptive Delta Modulation (ADM) is used. This provides for varying step sizes (Non Uniform Quantizing).

A large variety of ADM schemes are available. The one used in EA6B is based on the sequence of the output data bits. These are examined and, if a sequence of three consecutive 1's or three consecutive 0's are present, then the step size is varied.

In the EA6B the messages are stored in their ADM encoded form in the memories, and simply require passing through a demodulator to convert back to the analogue version of the original speech.

EA6B description

The EA6B consists of 12 identical circuit cards, each giving a two second message, and a signal level (Odb ± 3 dB) which makes further amplification on the SALT rack unnecessary. Figure 4 shows a block diagram of one of these cards.

A DC/DC converter from which all voltages are derived by each card, is powered from the −50 volt exchange battery. Timing pulses, generated by the crystal clock, are fed to the store addressing and counter, and to the digital to analogue converter. The store addressing and counter provides EPROM selection. The message store consists of either 2, 3 or 4 EPROMs on which the ADM coded message is stored, each EPROM holding 0.5 seconds of message.

The output from the message store is in parallel form, and this is converted into serial form by the parallel to serial converter. The serial data is converted back into an analogue signal by the digital to analogue converter. A low pass filter removes from the reconstituted signal any unwanted frequencies associated with the conversion from digital to analogue, before being fed to the SALT rack through the audio amplifier and output transformer.

Recording of Announcements

The EA6B is a replay only unit and the messages have to be recorded on the EPROMs using separate equipment. A master tape is produced in a recording studio to ensure good quality. This master tape is played into a special analogue to digital converter unit which converts the signal into serial ADM format. The serial data is stored on a short duration memory unit and then fed into an Intel Micro-Processor Development System (MDS) in parallel format. A program controls the MDS so that data can be transferred from the converter unit into the MDS and stored on disc. A facility is provided to allow the movement of the data so that gaps between words can be changed or complete words moved.

When a message is completed, and is in the correct order, the program provides for the data to be assembled into 0.5 second bursts and transferred onto a set of master EPROMs. These master EPROMs are then put onto an EPROM multi-copier and copies made for use on the EA6B.

Messages can be renewed or replaced by erasing the EPROM's under Ultra-Violet light and re-programming them if required

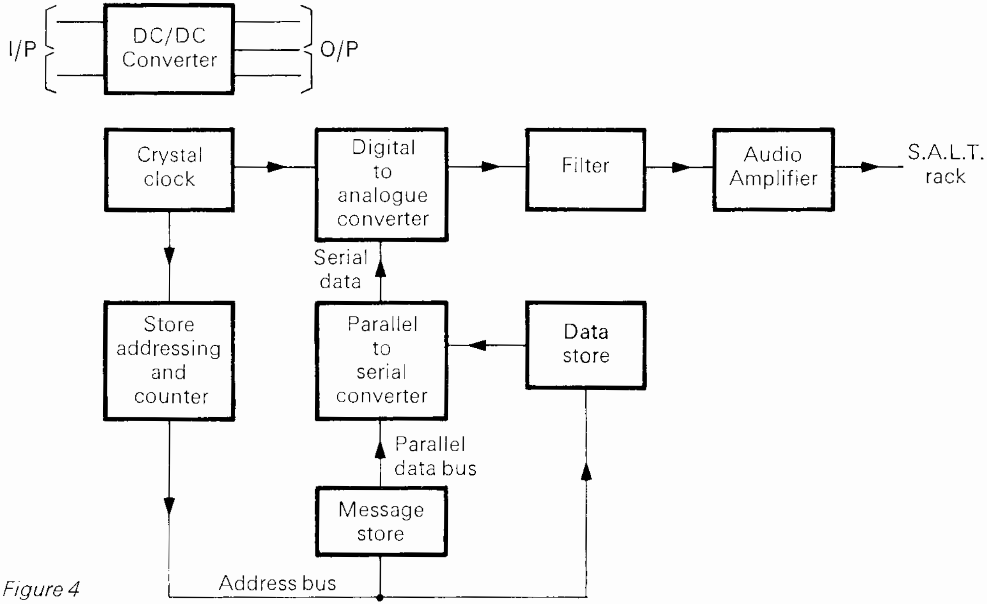


Figure 4

either using the EPROM copier or direct from the stored data on the MDS.

Future Development

By the use of a 32 kbit EPROM an 8 second announcement can be obtained. The announcement length can be further increased by the use of slave cards. Each slave card using 32 kbit EPROM's will give an extra 16 seconds of announcement and up to a maximum of 4 slave cards can be used. In this case the store addressing and counter circuit will select the next block of EPROMs to be output.

Evaluation of longer announcements using master and slave cards and 32 kbit EPROM's is in hand. Typical uses for these cards are, congestion announcements, auto-manual board temporary closure, paging systems, radio telephone systems and service difficulty messages.

Results so far show that this equipment has many advantages over the electro-mechanical announcers currently in use. There are no moving parts to wear out, and consistently good messages result as there are no mechanical adjustments to go outside limits. Being powered from the exchange battery, greater security is obtained.

01-432 2894

On reflection..

In this issue we look back to MN 11 (Spring 77) and invite authors to comment on their articles . . .

MAC Updated Again

In Issue 11, I said that 'subject to financial approval the programme of installations will eventually be extended to provide MAC throughout the country'. Financial approval was indeed given on 19th September 1977 and the 63rd and last processor equipment was installed at Warrington, Lancs. in November 1981. Since then effort has been directed to completing the access equipment installation programme, debugging the data, and, in general, preparing for the day when the results of MAC's test calls will be used for network performance assessment and improvement. (See my article in this issue).

Brian Sapsford ES9.3

Did We Save It?

Ron Smith informs us that in 1975/76 the energy bill in the Telecomms business was £23.7 million, and in 1981/82 it was £64 million. Over that period, our energy use increased from 8 million giga-Joules (MGJ) to 9.4 MGJ.

Maintenance staff are still the people best able to make worthwhile energy savings and all the points made in the original article are still valid. In today's cost-conscious BT, energy conservation is even more important than it was in 1977.

ETA5.1.2

(01-247 6244)

Cable Pressurisation Equipment
Gordon Bays reports that TD8.2.4 are in the process of evaluating an automatic cable pressure surveillance system using 'pressure and flow' measuring transducers which are scanned at regular intervals by a microprocessor installed at a central point. Status reports and alarms are automatically transmitted to a remote point for analysis – at an EPMC for example – over the pstn.

In the last few years T7.2.1 has been evaluating the principle of dry air stations. These produce dry air on the stop/start principle which is stored in an air receiver (TANK). The outcome of this exercise has been the development of two units known as a Compressor Desiccator Unit 1A (CDU 1A) for small/medium installations and a CDU 2A for large installations. These units show substantial energy savings, provide a reliable air supply more suitable to cable monitoring, are quiet in operation, modular in design, and should require less maintenance due to reduced running time.

The CDU 1A will shortly be available as a general item.
(01-739 3464 Ext 495)

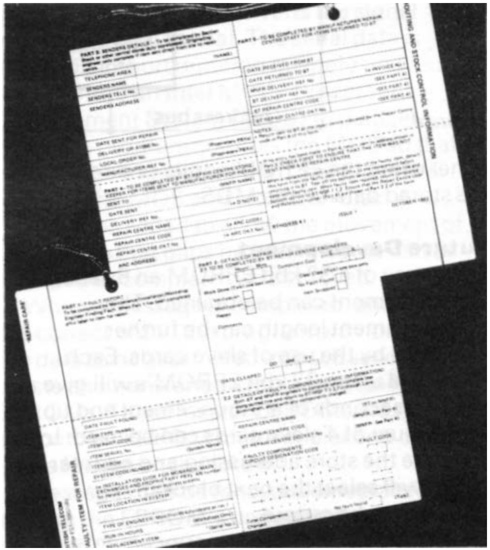
STD Metering
The original problem of revenue losses due to faults on STD metering is still with us. In fact, the situation seems to have deteriorated.

The current percentage figures from Telephone Service Observations (TSO) for overmetering are 0.1% and for undermetering are 0.4%, as against 0.2% and 0.3% in 1977.

This results in an estimate of lost revenue by BTSW of nearly £716,000 compared with £160,000 in 1977.

With the coming on stream of Measurement and Analysis Centres (MAC), more indication is given of metering errors. This should lead to more faults being found and go some way in reducing revenue loss due to undermetering on STD calls in the future.
Peter Brett, BTSW/SV1.1.2 (0272 295564)

New fault label – repair care



by **Roy Burrows** ES5.4.1
As part of a new scheme to standardise the label and fault docket attached to faulty items of electronic equipment returned to Area Repair Centres (ARC) a new label has been introduced.

Supplies of the label – known as ES1-8807(R) – have already been distributed to field maintenance staff, together with a plastic-covered instruction card.

Advantages with this new scheme – which has received the go-ahead from the POEU – are

- single type of fault label for all faulty units returned to ARCs
- standardised data and other information, making it simple to apply to the ARC computer-based docket system
- to keep track of all items sent to ARCs for repair, and those forwarded by an ARC to manufacturers under warranty agreements
- to allow essential repair cost information to be obtained when required for charging purposes.

It is envisaged that introducing this new label will do away with the multiplicity of different forms of statistical return called for previously by various maintenance and other operational groups in BTHQ.
01-432 2896

LABEL ES1-8807(R)

FIELD MAINTENANCE/INSTALLATION/SECTION STOCK ETC PROCEDURES.

1. Labels ES1-8807(R) are to be used for the return of any faulty electronic equipment to an Area Repair Centre (ARC). In particular, they are to be used for customer switching systems (MONARCH, HERALD, ENSIGN, REGENT, VICEROY, KINSMAN, SENATOR, AMBASSADOR and PMBX12) and PAYPHONES. They may be used for proprietary equipment (PBXs etc). Labels ES1-8807(R) form the basis of a system to monitor equipment reliability and are used for stock control. Complete labels ES1-8807(R) accurately and in the fullest detail.

2. **PROCEDURE**

2.1. BY MAINTENANCE/INSTALLATION/WORKSHOP/ ASSEMBLY CENTRE ENGINEERS

- Complete part 1 of the label (see para 3)
- Affix label to faulty item
- Send item with label attached as normal for repair
- When an item is to be sent direct from site to the ARC or, in the case of proprietary equipment, direct to the manufacturer, complete part 3 of label giving senders details.

2.2. BY SECTION STOCK AND PAYPHONE MAINTENANCE CENTRE (PMC).

- Ensure that any item being returned as faulty for repair has a label ES1-8807(R) attached with part 1 completed. ARCs will not accept equipment without a properly completed label attached.
- Complete part 3 of label for senders details (see para 4).
- Send item for repair (with label attached) as normal.
- SECTION STOCKS – maintain a stock of labels ES1-8807(R) for use by field staff etc.
- Section stocks only can obtain replenishment stocks of labels ES1-8807(R).
- Submit requests via Regional Stores Liaison duty to BTHQ/ES5.4.1.

3. **NOTES ON COMPLETION OF LABEL ES1-8807(R) PART 1**

- ITEM TYPE (NAME):- enter commonly-used/accepted title for the item, i.e. EXCHANGE LINE UNIT, HS TERMINAL, CARD RECEIVER, etc
- ITEM PART CODE:- enter SA/SAW diagram number for BT equipment (i.e. 1A1/SA20034, 1A2/SA20005 etc). For proprietary equipment enter the commonly-used manufacturers item description code part number, unit code etc.
- ITEM FROM:- enter Brand name of system from which faulty item came i.e. MONARCH, HERALD, ENSIGN, BLUE PAYPHONE, CARDPHONE, ETC
- SERIAL NUMBER - Serial numbers (where used) are typically indicated by means of a white stick-on label affixed to item PCB. NOTE: BE CAREFUL NOT TO CONFUSE SERIAL NUMBER LABELS WITH BT AREA REPAIR CENTRE LABELS, WHICH WILL BE COLOURED AND WILL TYPICALLY SHOW AN AREA REPAIR CENTRE (ARC) NAME and/or CODE and A UNIQUE JOB REFERENCE NUMBER. The ARC label indicates that the item has previously been handled by an ARC.
- SYSTEM CODE/NUMBER - For MONARCH enter the 10 digit site specific customer INSTALLATION CODE. For HERALD and all other BT customer switching systems enter the provided Advise Note (AN) number where known. Do not enter the customer telephone number for BT equipment.
- ITEM LOCATION IN SYSTEM:- enter exact physical location of item in system such as shelf number/port etc.
- REPLACEMENT ITEM SERIAL NO:- enter serial number of item used as replacement for faulty item. Note: no entry is necessary for proprietary equipment.

4. **NOTES ON COMPLETION OF LABEL ES1-8807(R) PART 3**

- TELEPHONE AREA:- enter NAME of the originating Telephone Area
- SENDERS NAME, TELE NO. and ADDRESS:- enter address of where repaired item is to be returned (i.e. Section Stock) and a name and telephone number for answering enquiries.
- DELIVERY OR A1066 NUMBER:- when a 'trip-D' form (A1007) A1006 or other delivery form is sent with item to repair centre, enter the form reference/serial number.
- LOCAL ORDER/MANUFACTURER REF. NO.:- complete only for proprietary PBXs.

BT/IDHQ/ES5.4.1 ISSUE 1 November 1982

If you have a contribution to offer to *Maintenance News* other than a letter to the editor, please forward it through normal channels to the *Maintenance News* agent for your Region or Telecommunications Board. The list is shown 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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