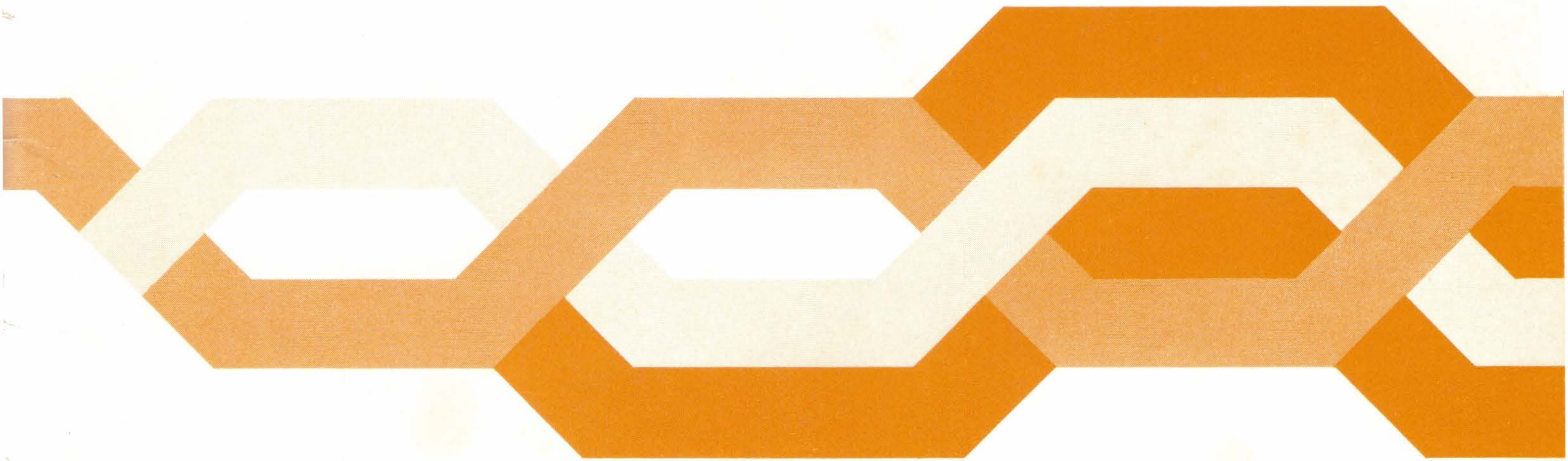
# Maintenance News

15
Autumn
1979



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# Contents

# Editorial

## Safety first – and last

Just before he retired as THQ Engineering Safety Officer, Henry Brown offered *MN* two articles on engineering safety. In this issue I have published the first of them. By now, all of you must have heard of the Health and Safety at Work etc Act (1974) – often abbreviated to H&SW or HASAW – so it is appropriate to include in *'MN'* something helpful on the subject. Thank you Henry, we wish you a long, happy and *safe* retirement.
Ron Quinney
Editor

# Service to the customer

by **Bill Adams**

**Here, the former Deputy Director of Service focuses our attention on what we, in maintenance, are trying to achieve.**

Of all the staff employed on the very wide diversity of work in the Telecommunications Business, people on maintenance need reminding least of the importance of customer service.

This very useful publication necessarily tends to concentrate on maintenance. But it was thought that a short article about service would remind us of what we are trying to achieve – which can all too easily slip into the background under the immediate pressures of day-to-day problems.

## How do we measure service?

Although all of you will be familiar with the service targets for your own particular unit or activity, I will briefly re-cap on the four main measures used for the inland service using Telecomms Improvement Plans. These, colloquially known as 'TIPs', are:

*TIP1* = *Fault Reports per station per annum.*
*TIP2* = *Percentage faults cleared by the end of day after day of report.*
*TIP3* = *Local Automatic Service. Call failures due to PO.*
*TIP4* = *Trunk Automatic Service.*

There are also TIPs, not included in this article, for international and for the operator services.

TIP1 has a number of components – fault reports due to exchange equipment, customer apparatus, PABXs, external plant, FNF and RWTs. Fig 1 shows that TIP1 has improved substantially over the years – from 1.10 in 1964/65 to 0.64 last year. All classes of plant have contributed to this improvement, but the most significant is that due to exchanges which brings with it a parallel reduction in RWTs and FNFs.

It should be noted that TIP1 does not include Public Call Offices (PCOs). A separate TIP – TIP5 – covered PCOs, but a new method of assessment is currently under trial.

Historical comparisons of TIP2 are not easy because measurement methods have changed over the years. One thing is clear, though, it had steadily worsened. Admittedly last year's performance was affected by industrial action and by the worst weather for many years. But at 49.9 per cent we cannot be particularly proud of this service. The main problem is the vulnerability of our local external plant, so it is vital that new plant is installed to the best current standards. Old, fault-prone, plant must be identified also, and brought up to these standards.

The automatic service TIPs have two components: calls which fail due to

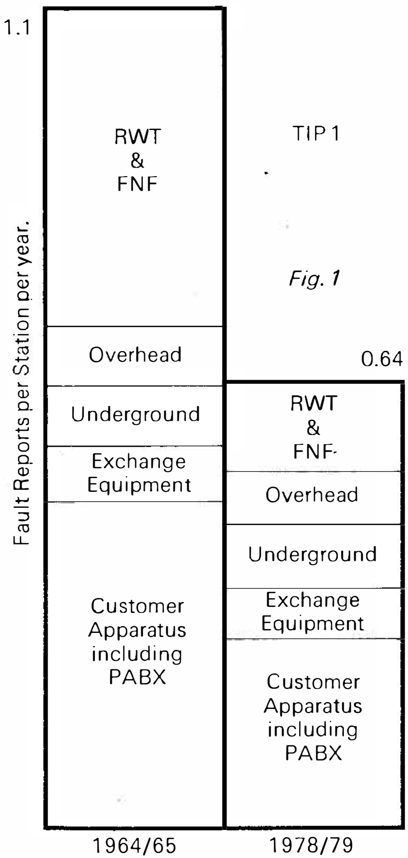



*Fig. 1*

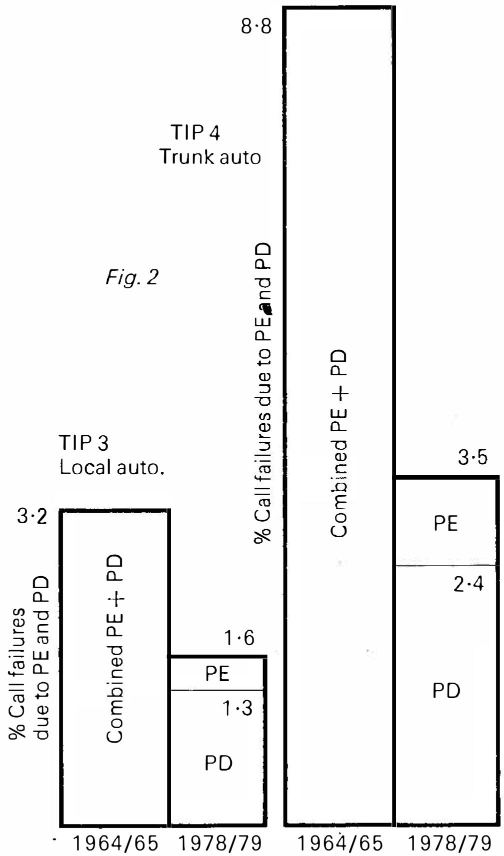



*Fig. 2*

congestion (PE) and those due to plant defects (PD). Overall, TIP3 has improved from 3.2 per cent to 1.6 per cent between 64/65 and 78/79 and TIP4 from 8.8 per cent to 3.5 per cent – illustrated by figure 2. Both PE & PD have substantially reduced, but in both TIPs PD is now the dominant factor.

Modernisation of exchange equipment should bring about a continued reduction in PD, but we must also continue to get the best out of the older systems. In this we believe that Measurement and Analysis Centres (MAC) have major roles to play.

**How does the customer see it ?**

On the face of it, with the exception of TIP2, things as we measure and record them – look quite good ; a good record of past improvement with more to come. Unfortunately though, what we measure is not what the individual customer experiences. Even if it were, it would not necessarily give any lead as to his opinion of the service. This is because our measures are averages : averages over time, and over larger and larger territories as figures are accumulated to form area, regional and national results. Within these averages there are wide ranges of performance, from very good to very bad. The very good need not concern us, but it is the very bad experiences which largely determine the public views of the efficiency of the service. One of our major aims is not only to improve the averages but also to eliminate the 'unfortunate' customer by reducing the present wide spread in performance.

In addition to this spread, some of our present methods of measurement are inadequate. For instance TIP3 is measured at the first common switching stage, thus omitting from measurement (but not from customer's experience) all calls which fail due to customer dedicated plant such as his line and telephone instrument. TIP4 is worse still, as measurements are taken at the register access relay set at the GSC, thus omitting the whole network from the customer's telephone to that point. These defects, together with the use of averages, and the fact that overall only some 65 per cent of call attempts succeed, must account for the degree of disbelief which tends to greet such statements as : 'only 1.6 per cent of local calls fail due to PO'.

## Better information needed

When unduly poor service is suspected, MAC will help a lot by providing more accurate measurements, as well as allowing measurement at particular times or of particular routes. But it will still not cover the whole customer-to-customer experience. It is not what we measure that counts, but what the customer actually experiences, so we are studying how this parameter might be systematically measured in the future. So important is this area of our activity that we will need to put more effort into service measurement. One can foresee, sometime in the future, three distinct types of service measure by which our performance will be judged :

- ☐ what we measure as system performance
- ☐ what the customer experiences
- ☐ what the customer thinks he experiences

If there is to be any hope of achieving customer satisfaction, a service industry such as ours needs more information about its basic 'product' than is currently available.

## International comparisons

It's far from easy in a service industry operating with a monopoly, to judge what is a good acceptable service to customers in relation to the price they are asked to pay. In a competitive environment, customers' express their collective views by moving to an alternative supplier if he more closely meets their cost/service needs – but customers cannot do this for their telecommunication services. The only external yardstick by which we can form a judgement is to look at overseas performances. There are considerable difficulties in obtaining information from foreign administrations. Naturally, they do not wish to expose any weaknesses. Once obtained, there are even more problems in understanding what it means and relating it to UK measurements. Apart from the obvious problems of language and differences in technical jargon, no two countries seem to measure exactly the same things in exactly the same way. Nonetheless, foreign performance figures are worth close study and, in a number of instances, provide valuable pointers as to the direction in which we should be moving. Two in particular are TIP1 and TIP2. Despite the improvement in TIP1, we are significantly behind most overseas countries and seriously behind the best. The biggest single factor in this is the customer apparatus fault-rate (several countries quote 0.1 faults per station per annum or better, against our 0.24) and we are having to seriously re-think our approach to the reliability standards for our normal telephone instruments.

Standards for repair services vary widely over the world. If we were achieving our current target of around 90 per cent by the end of the second day, we would be about average. But this would still be inferior to the best two or three countries. Clearly, we need to get back to achieving our present targets. When we can do this consistently we will need to consider how to put ourselves in the same league as those countries which lead the world at present. This may involve re-thinking our present type of target altogether.

Comparisons between automatic services are particularly difficult because of network differences, definition of types of call, methods of measurement and so on. However, the UK appears to be an average performer on local calls, but somewhat below average for STD calls.

Much will depend on exchange modernisation in reducing the PD component of lost calls, but maintenance can help significantly by keeping up the level of serviceability of switching and transmission plant.
(01-432 9012)

# The digital network—a glimpse into the future

**Here is another in the series of articles to introduce maintenance staff to the new era of System X exchanges and digital networks. Before we "glimpse into the future" it may be helpful to explain two terms: analogue and digital, as applied to Telecommunications . . .**

An analogue signal continuously varies. An example is the electrical version of an original speech waveform. In an *analogue* telephony network circuits are connected together at audio frequencies over physical paths using relays and switches in a 'space switching' mode. The speech-band analogue signals (nominally 4kHz bandwidth) are carried on 2-wire circuits in the local network and on 4-wire linearly-amplified circuits in the junction network. Over the trunk network several analogue circuits share a common path using the technique of frequency division multiplexing (FDM). By this process the individual 4kHz bandwidth signals are converted into separate channels in a higher frequency band where amplification and transmission can take place over co-axial cables and microwave radio systems.

It is also possible to convert speech (analogue) signals, as well as signalling information, into digital form. Such a digital signal is characterised by the presence or absence of a pulse during a series of discrete time intervals or 'slots'. A digital signal having one of two states is known as a *bi*nary signal. Systems designed for digital transmission operate at a defined number of *bi*nary dig*its* (bits) per second – abbreviated to bit/s. Digital signals relating to individual circuits can be regenerated and combined together by an interleaving process known as Time Division Multiplexing (TDM), and transmitted over a system capable of carrying the resulting higher bit-rate digital signal. It is possible to switch individual calls in a digital network by switching from a time-slot in one system to either the same or a different slot in another – comparable to space-switching in the present analogue systems. It is important to note that, whereas digital data transmission over an analogue system requires a 'modem' (*mod*ulator-*dem*odulator) to convert the digital signals into analogue form, with a digital network no modem is needed.

**Benefits**

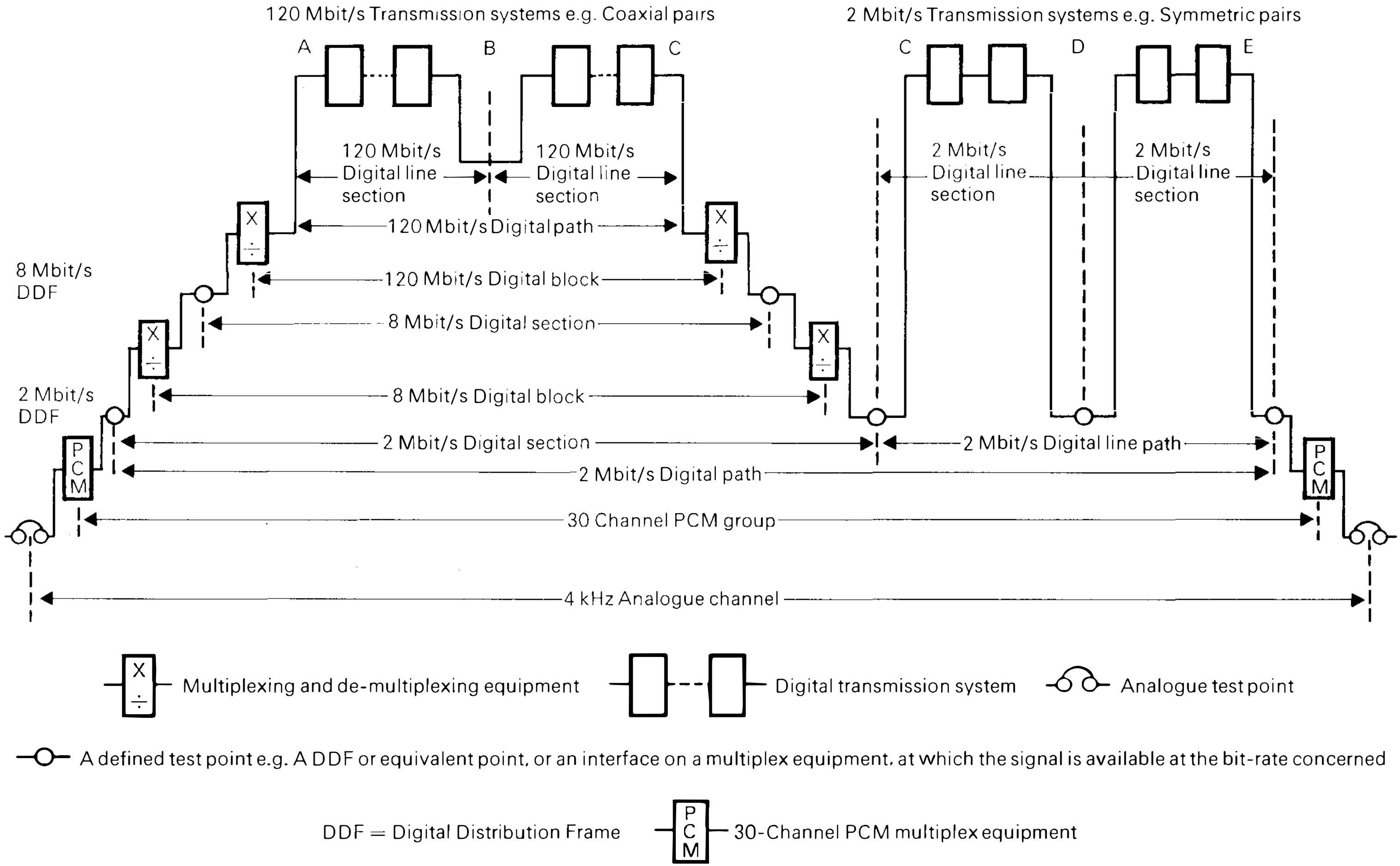
System X exchanges will start to appear in 1980. Ultimately they will become part of the integrated services digital network offering a number of benefits. *MN13* covered some of these, for example:

- ☐ the potential to hold down charges to the customer
- ☐ to improve existing services
- ☐ to provide a greater range of customer services and facilities.

This article aims to provide a glimpse of how plans are likely to be translated into reality.

**Transition**

The present network of analogue line-transmission systems, interconnected by space switches, is based on the 1960 routing, switching and transmission plans. This will gradually change – through an evolving network comprising a mixture of the existing plan, the new digital plan, and some inter-working circuits – until all analogue switching units and circuits are eventually replaced. The transition from the 1960 Plan – which provides a network of nominally 4kHz bandwidth circuits – to the digital plan – which will provide a network to convey information at 64kbit/s – has to be carried out in such a way that the existing performance limits are not significantly degraded. It is also important not to incur undue expenditure on expedient methods of providing plant and equipment of limited life and usefulness. The first 2Mbit/s and higher-order digital transmission systems are now being brought into service. No more analogue line and radio system capacity will be added to the network for inland requirements. Growth of analogue circuits is now confined to using up analogue capacity on already-installed plant.




*Note:* The analogue (speech) signal is converted into a digital signal by the Pulse Code Modulation (PCM) equipment.

*Fig. 1 A 4 kHz Analogue channel routed over several digital systems in tandem.*

Routes between the main switching centres in the digital network (known as Digital Main Network Switching Centres – DMNSC) will, as far as possible, be planned to be on digital plant.

**The digital plan**

An interim plan is being drawn up to provide a digitally interconnected network of System X exchanges (main and local) to serve about 30 principal centres by the mid-1980's. The aim is to bring the benefits of System X to the greatest number of customers at the earliest possible time. The final choice of locations for the new exchanges is a difficult one, and a joint THQ-Regional committee meets regularly to deal with this problem. Another aim is to ensure that all necessary TIs will be available to the field in time for implementation.

In the evolving network, circuits will be provided

- analogue at each end
- analogue one end and digital the other
- digital at each end

Those with a digital presentation at one or both ends will need changes in provision practice, and an important objective will be to streamline provision procedures. This will become necessary in order to match the potentially greater speed with which it will be possible to install and commission a digital exchange, as compared with present types. During the transition period, some circuits presented analogue each end may be routed partly over digital plant (and *vice versa*) on economic grounds. Special converters known as 'transmultiplexers' will allow such tandem connections of 8Mbit/s

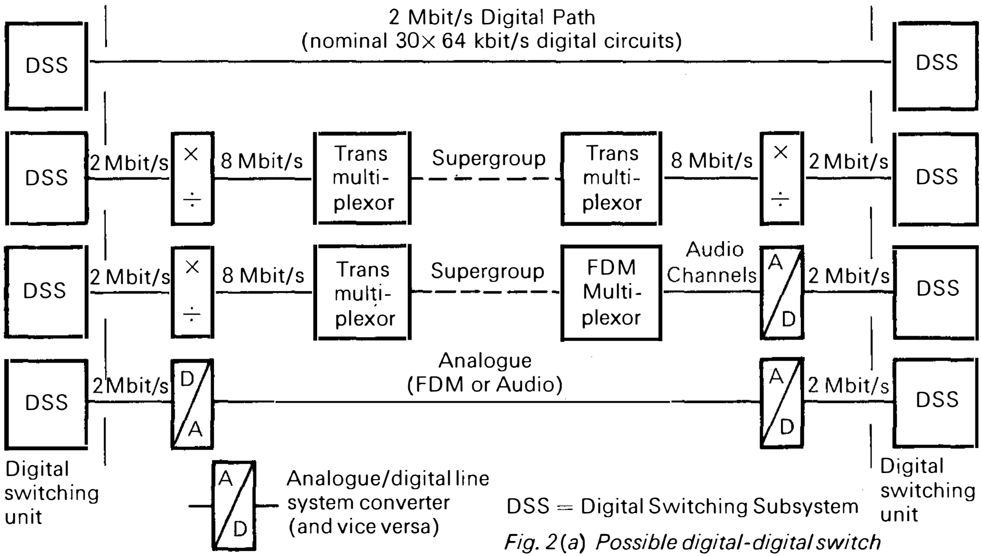



*Fig. 2(a) Possible digital-digital switch circuit configurations*

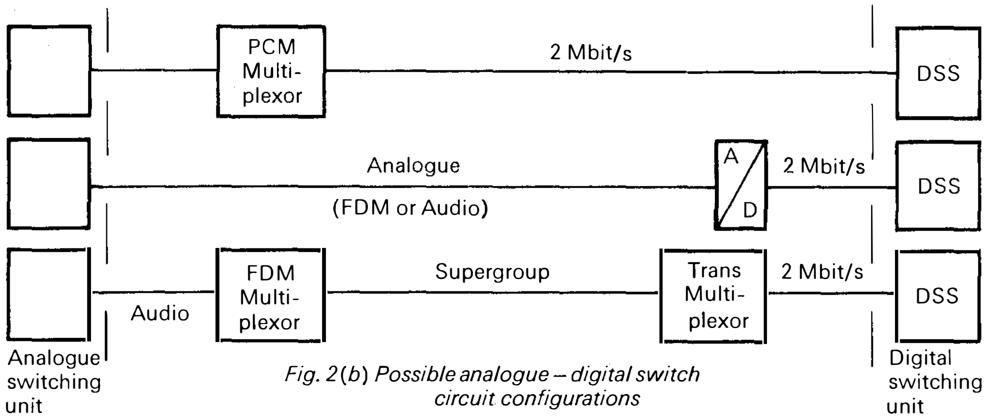



*Fig. 2(b) Possible analogue – digital switch circuit configurations* digital paths to analogue supergroup paths.

Fig. 1 shows the various digital line systems (DLS) that will go to make up the digital transmission hierarchy.

Fig. 2 shows some of the various configurations that may be met in connecting both analogue and digital exchanges together in the evolving network.

## Easier circuit provision

With the new integrated digital switching and transmission network it is envisaged that it will be a relatively simple matter to set-up routing for both private and public circuits via semi-permanent connections* through a digital switch. On the authority of a Circuit Advice, instructions may be input on a visual display unit (VDU) located at a Local Administrative Centre (LAC). It may also prove feasible to extend this 'software control' technique to a much wider range of circuit requirements – for example: the teeing, splitting, combining and branching functions found in omnibus and multipoint circuits.

Other advantages for the provision of private circuits should come from simplified setting-up and lining-up, and a shorter time-to-provide. Because the performance of a digital circuit will be virtually independent of its length, it will become a simple matter to set-up the main section of a long-distance circuit, and testing between local exchanges will become one of a simple digital error-rate test. The analogue extension

**A semi-permanent connection is a connection set up through the digital exchange for the duration of time the circuit is rented to the customer.*

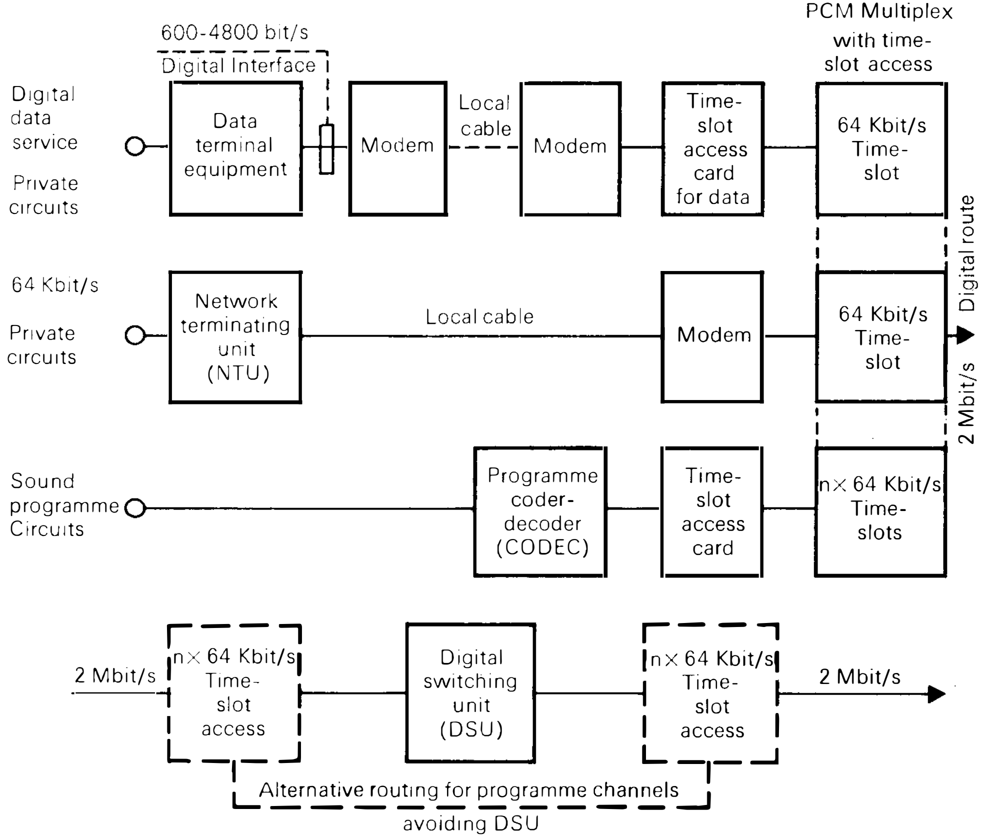



*Fig. 3 Possible digital data and programme circuit configurations*

of the circuit to the customer's premises at each end may well be processed in the same way as an exchange line – to all intents and purposes, on demand!

**New services**

The availability of end-to-end 64kbit/s digital paths between local exchanges will allow digital interfaces to be extended into customer's premises to provide for standardised data-transmission rates. This will offer the prospect of a new range of digital services, including

- access to the proposed digital data network
- Packet switched service access
- fast facsimile and datel
- enhanced Prestel and word-processing services

Also, by renting multiples of standard 64kbit/s connections (for example, a 2Mbit/s block with a capacity of up to 30 circuits):

- private circuits to interconnect digital PBXs
- multi-channel audio or video circuits for broadcasters.

The PO currently offers a sound Outside Broadcast Service – nominally 10kHz bandwidth – using a network of Occasional Programme (OP) circuits. It is also used to provide temporary inter-studio connections. This OP network is likely to be gradually replaced by digital routings by multiplexing several 15kHz sound programme channels onto a 2Mbit/s digital path. The path may be used exclusively by five or six programme channels or, where only one or two mono circuits (or a stereo pair) are required, it can be shared with telephony channels. Studies are in hand to determine the economic feasibility of providing 'programme codecs' – devices for digitally *co*ding/*dec*oding the (analogue) programme signal. These codecs will use the 12 x 64kbit/s time-slots being made available for data transmission on the new generation of pulse code modulation (PCM) multiplex equipment. When other technical problems have been resolved (for example, maintaining time-slot integrity (TSI) on an n x 64kbit/s connection) it may be possible to route sound programme channels *via* semi-permanent digital switch connections and/or *via* time-slot access (TSA) equipment. This would enable a digital switch to be bypassed while keeping the signal in digital form, thereby providing maximum flexibility in the setting-up and distribution of sound programme facilities.

An illustration of how some types of future private data and sound programme circuits may be provided is shown in Fig. 3. Although studies are still in hand to determine how best to extend a digital line on local plant, it will not be long before this exciting glimpse into the future will have become a reality.

# Postcodes rule –OK

by **Mollie Edwards** *CHQ Information Bureau*

This year is an important one for the Postal Business in its programme of mechanising its sorting offices. The installation of the latest electronic equipment for letter handling is being speeded up. Because the ultimate success of the mechanised system depends on everyone using postcodes, the PO has launched a major publicity campaign. A main feature of this drive will be giving every householder local postcode information.

Only 45 per cent of the 30 million letters posted each day in Britain carry a postcode, clearly not enough to make really effective use of the automated processes. So, part of the campaign of persuading the public is also to encourage PO staff to use postcodes to a far greater extent than now. And what are the advantages of postcodes? Well, by summarising an address in a coded form it is easily converted to machine-readable language. This enables automatic sorting of mail at all stages in a letter's journey – right through to the delivery postman. This will help the Postal Business to contain costs and maintain efficiency. We can all do our bit by using postcodes on all our mail – and by encouraging others to do so.

CHQ/PRD (01-631 2409)

# Seal of approval

by **Alan Wilson** Sv5.1.1

Your safety is our concern. So, once again we are highlighting the need to ensure that dangerous gases are not allowed to enter PO operational buildings *via* our own cable ducts —or from any other underground service duct or aperture for that matter. Articles in *MN 4* and 7 have already drawn your attention to the problem, but we hope this reminder will be accepted in the right spirit. We in THQ would like to share our concern about duct seals with you all – especially all officers in charge of PO operational buildings and all supervising officers responsible for external works.

### Defend yourself

The first line of defence is an effective gas seal. Make sure such seals are provided – then continue to maintain them in sound condition That's the best advice we can give.

Duct seals can be of the following types :

- plumbed to a lead fascia plate
- PVC compression type using Compound No 16
- Resin Packs No 7A or other approved compounds

Duct sealing is fully explained in *TI A2 F0452*.

### See all seals

A duct seal can be disturbed accidentally – even without realising it. So it makes sense to inspect all seals after anyone has been into a cable chamber. *TI E3 H1120* explains how to carry out the inspection. If a duct seal is disturbed for cabling operations, a temporary gas monitor *must* be provided – see *TI E1 A1507*.

Where the effectiveness of a duct seal is in doubt, or is thought to be inadequate in any way, and you cannot provide exchange manhole ventilation, then gas monitors should be *permanently* installed.

A mandatory instruction (*TI A2 C0213*) sets out the policy governing the protection of operational buildings against the ingress of gas

Remember ! It's better to be late in this world spending 30 minutes checking the gas seal, than to arrive 30 years too early in the next ! Make sure your ducts have got that **'Seal of approval'** !

Sv5.1.1 (01-432 1372)

# Engineering safety

by **Henry Brown**

Safety is everyone's business !

Accidents don't happen – they are caused !

Such cliches appear *ad nauseam* in any article on safety – possibly because they are true !

Not all accidents cause injury. The heavy item you dropped which just missed your sandalled toes ; the knife you mishandled which just missed your knuckles, are both examples of accidents you didn't intend. But they needed only a slight change of position to become two more accident statistics. Safety training is directed towards avoiding all accidents, and the near-misses are not recorded. If we can avoid those near-misses because of conscious care and thought-out action, we are much more likely to avoid the injuries.

Engineering staff in the Telecomms Business suffer a depressingly regular 10500-12000 injury-causing accidents each year. You might think that the figures could be influenced by an individual's decision whether to report the accident or not. This may be, as it is certain that not all minor injuries are reported. Another depressing fact is that nearly 30 per cent of these involve sick leave, averaging 3300 cases per year, and are not so subject to the vagaries of individual reporting.

Who has the accidents ? Of what kind ? Table 1 analyses all injury-causing accidents into very broad occupational groups over a 12 month period.

**Handling** – poles, manhole covers, cables, batteries, pumps, generators, racks, PBX's, stores – you name it – causes by far the most injuries, about one third of this sample. This is roughly the same as the national average for all industry.

**Falls** of all kinds – on rough ground, on the level, from ladders, steps and stools, getting in and out of vehicles and many on stairs – add up to another 22 per cent.

**Stepping on or striking against** – the awkward movement against racks, drawers or other protruberances, treading on upturned nails, bumps and knocks of all kinds – take another 18 per cent.

## Human error

So about 70 per cent of all accidents are caused by – what ? Short cuts to get the job done ? Moments of mental aberration ? Or just plain carelessness ? Special studies of random samples of accidents carried out each quarter, indicate that about 80-85 per cent of recorded accidents contain major elements of *human error.* They also reveal another fact : many accidents occurred because non-standard techniques and practices were adopted , and worse, that the current safe practices described in TI's were not always known.

## A closer look

Statistics can be misleading as well as informative. If you look at numbers of accidents in Table 1 it seems that CA and L and installers have most accidents. But Table 2 shows these accidents related to the population in each group exposed to risk, and the accidents per 1000 staff per year.

The high-risk people now, surprisingly, turn out to be those working internally on power and equipment in situations within our control, as opposed to others in situations over which we have no control. And the bulk of their accidents are of the mundane three types just mentioned, rather than being due to technical hazards from equipment or power. I should say, too, that their injuries tend to be less severe than those of external workers on heavier duties. Perhaps the accident book is just that much more handy !

A look now at the Health and Safety at Work Act 1974. . .

Well of course, it has nothing to say in the way of detailed advice, but plenty to say in laying down broad principles. It puts onus on us all to comply with its precepts under pain of punishment if we don't ! First, the Act makes it the duty of every employer to provide and maintain, so far as is reasonably practicable :

- ☐ *Plant* and *systems or work* that are safe and without risk to health
- ☐ A *place or work, access* to and *egress* from which is safe and without risks to health

Table 1

| | Handling | Falls | Stepping on and Striking against | Objects Falling | Hand Tools | Animals | Power-Vehicles Machinery | Explosives Fire Hot-Substances | Misc | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| Cablers | 190 | 91 | 66 | 36 | 43 | 5 | 14 | 8 | 30 | 483 |
| Overhead | 253 | 161 | 92 | 66 | 69 | 11 | 21 | 10 | 46 | 729 |
| Jointers | 689 | 367 | 240 | 132 | 181 | 23 | 25 | 83 | 102 | 1842 |
| Customer Apparatus Installation and Maintenance | 753 | 664 | 510 | 224 | 209 | 181 | 24 | 53 | 179 | 2797 |
| Exchange Transmission Telegraphs | 435 | 390 | 461 | 150 | 136 | 2 | 19 | 123 | 84 | 1800 |
| Power | 189 | 136 | 128 | 64 | 70 | — | 17 | 38 | 30 | 672 |
| Misc – all others | 720 | 528 | 428 | 173 | 149 | 27 | 69 | 92 | 124 | 2310 |
| Totals | 3229 | 2337 | 1925 | 845 | 857 | 249 | 189 | 407 | 595 | 10633 |

Table 2

| | Total Staff | No. of Accidents per year | Accidents per 1000 per year |
|---|---|---|---|
| Cablers | 2871 | 483 | 168 |
| Overhead | 3413 | 729 | 214 |
| Jointers | 14071 | 1842 | 131 |
| Customer Apparatus Installation and Maintenance | 23438 | 2797 | 119 |
| Exchanges Transmission Telegraphs | 8078 | 1800 | 223 |
| Power | 2862 | 672 | 235 |
| Misc.–all others | 48355 | 2310 | 48 |
| | 103088 | 10633 | 103 |

- ☐ A *working environment* that is safe and without risks to health with adequate *welfare* facilities
- ☐ Arrangements for ensuring safety and absence of risk to health in the *use, handling, storage* and *transport* of *articles* and *substances*.

These are pretty all-embracing requirements.

**Joint responsibility**

For many years the Business has tried to provide safe buildings, accommodation and practices – with some considerable success. Most of the design standards for equipment, tools and aids, as well as works practices, are carefully thought out with safety in mind. They are only brought into service after scrutiny and joint agreement between staff representatives and management.

Engineering techniques and practices are monitored by the Experimental Changes of Practice Committee No 1 (ECOPC1). This can rightly be regarded as the prime engineering safety committee of the Business. With its roots extending as far back as 1928, it anticipated the Act by many years. Nevertheless nothing is perfect. Things slip through despite care. Being human, we occasionally find out from accidents which have occurred. Sometimes an alert person brings it to notice. Then, there's the failure to foresee a hazard which, with a struggle, has to be put right – without creating further hazard. The Minutes of ECOPC1 show the wide range of problems being dealt with. So the general safety standards are being raised, in theory I say *in theory* because all that THQ can do 'at the end of the day' is to issue bits of paper – new or amended TIs, THQ Circulars, Safety Memoranda and so on. What happens to them afterwards, who reads them and, more importantly, takes appropriate *action* is anybody's guess. Standards are only raised in fact when warnings are heeded and approved methods applied. Which brings me to another of the Act's requirements. . . .

**The employer's duty**

The employer has a duty to provide such *information, instruction, training and supervision* as is necessary to ensure, so far as is reasonably practicable, the health and safety of his employees. So, if you thought the earlier part of this article with its story of human failures was aimed at you, the worker, well it was ! But not only at you. For in most cases of human failure not involving gross negligence, it is usually the case that management has also failed somehow in one, or any combination of, the above four requirements. ECOPC1 has recognised this, and is being considerably exercised in seeing how the information gap can be closed. The problem is, how improved practices and techniques etc, can be brought to notice right down to the workplace, where it matters, without increasing the flood of paper. Another problem is whether some sort of refresher training is needed to bring staff up-to-date on new techniques to reinforce knowledge.

The third important duty in the Act is for a business to care for those *not* employed in it, but who may be affected by its actions. Each employer must conduct his business in such a way that *persons not in his employ* are not exposed to risks to health or safety This is extended also to ensuring that those *not in his employ who use his premises as a* *place of work* are also protected. To us in the PO, this means the public at large, and also that contractors' staff, who come in to work (plumbers, electricians, cleaners, for example) are included, as well as equipment contractors. Generally, if we have done our job in making premises safe for our own staff, this requirement is likely to be met. But let's look more closely what this means when working in public streets or in our customers' premises. Our working must not put others at risk. So we must guard open holes, work sites, and so on, to the standards laid down in TIs and the Road Works Guarding Manual. We must leave installations which are physically, mechanically and electrically safe. We must not create hazards for others during the course of our work. If you have to take up floor boards or trap doors, make sure no one can fall into them if you cannot be there all the time. That includes children. For example don't leave wire or cable-ends dangling at eye level. Use your common sense by assuming that *no-one else will use theirs.*

## Over to you

The other side of the coin applies to *your* safety in other people's premises. I suppose we could say, purely applying the Act, that if the PO has supplied you with a reasonably safe vehicle, tools, equipment and stores, and a safe system of works in which you have been properly trained, then the liability for your safety from hazards within his premises, is entirely that of the customers. This may be true from the legal viewpoint, but we don't think it good enough, because firms' standards vary so much. We want to avoid accidents – not liabilities. You are generally safe enough with such reputable firms as Fords, Shell or ICL, because they have well-developed safety systems – so long as you comply with them and don't try to by-pass them in any way. But, as you might not be so well protected in lesser organisations, we have written more bits of paper for your guidance. Have a look at TI's *M4 E0104, E0599, E2041, E2060, E4050, E4051, E4053* and *E5 H0006* for a start. Nevertheless, telecomms work takes staff into industrial premises of every kind, so somewhere every type of industrial hazard known, and unknown, will be met. These TIs contain some safety principles, precautions and some of the risks involved. To extend them to cover all possible hazards you could encounter would comprise a library of reading you wouldn't get through in your working life. The main feature which will keep you out of trouble, is alert and intelligent use of your own eyes and ears. If there is evidence of likely danger, discuss it with the safety or supervising staff on site. They are not likely to brush you off, the law applies to them too. If you are not satisfied with the outcome, and still think there is unacceptable risk, inform your supervisors, via the appropriate control.

One other thing the Act says, which has personal relevance to us all, is that it is the duty of *every employee to take reasonable care for the health and safety of himself and others who may be affected by his acts or omissions at work.* He also has to cooperate with his employer to enable any duty or requirement imposed on him (the employer) by the Act to be compiled with. This means carrying out work in the safe standard ways laid down in TIs for the job. This subject is admirably expounded in Lou Gyseman's article in the POEU Journal April 1979 which I heartily commend to you.

## Co-operation

We are all involved in achieving safe working. The theme is, after individual personal care : *co-operation.* Co-operation between management and unions at HQ to provide safer equipment and techniques ; co-operation at Regional and Area levels in Safety Committees in implementing instructions and dealing with local safety difficulties ; co-operation with Safety Officers and Safety Representatives in bringing hazards to notice and dealing with them ; and finally *your* co-operation. Take the trouble to keep yourself informed and up-to-date on your work and the care to perform it safely. Have another look through the M4E series of TIs – you might find something useful. It is all worth it for a long and injury-free life.
OP11.1 (01-739 3464 x443)

# Metering

by **Brian Hensman,** Sv6.5.6

*Question – do you believe there can be smoke without fire ?*

Every billing quarter some 50,000 requests for special meter tests are issued by our Traffic and Accounts Division, on A3732 forms. A percentage of these are bills diverted by the billing computer due, for instance, to unusual increases in dialled meter units (DMUs) or no change in DMUs since the last quarter. However, a large proportion of A3732s stem directly from customer complaints.

Now, let's put that question another way – *Do customers complain just for the sake of it, or have we gremlins in our metering system ?* Most of you will have a good idea of the complexity of our metering system. For example, we need to discriminate between ordinary, coinbox, local, STD and, increasingly, ISD. Every one of these has its own inherent difficulties, but how large is the problem, and how is it best tackled ?

In 1978, THQ set out to answer these questions. The main objective was to eradicate known equipment failures, particularly those causing overmetering. To assist with this task, each region nominated an officer from its Service Division to act as a Metering Liaison Duty. (Do you know who it is in your Region ?).

## Metering improvement plans

The practical aims of the Metering Liaison Duties are determined in discussion with THQ resulting in the issue of Metering Improvement Plans (MIPs). You may already have seen some MIPs but a brief description of those so far issued is given at the end of this article.

Surveys (of the kind mentioned in *MN7* 'Metering Faults') usually highlight problems which may otherwise go unnoticed during normal maintenance procedures. It is in this area we think you have an important part to play, by advising your regional metering man of any common metering faults.

For example, of those 50,000 A3732 forms issued each quarter, 4500 (9 per cent) yield faults. Of those, 4000 are concerned with no metering or undermetering, and the remaining 500 overmetering. It can be seen that, from so many complaints, only 1 per cent result in an overmetering fault being found. But what are these faults ? Are they random, or are there common areas repeatedly coming up ? However the faults are found in your exchange, whether by performing the A3732 or A3218 procedures (see *MN 5* 'Subscribers Meters') or during normal maintenance tasks, tell your regionally-appointed metering officer. He will then consider the implications of your report and decide if your problem should be put before the next committee meeting for remedial action to be taken.

## MIPs issued to the field by THQ

*MIP 1 (November 1978)*
*To check correct operation of relays U and V in Non-Dir Controlling Registers Type 2/3. Results so far from 9 Regions: 566 faults in 6916 registers.*

*MIP 2 (February 1979)*
*To check First Code Selectors at Local Dir exchanges to ensure that correct metering conditions can be passed over the M wire. Results so far from 3 Regions: 36187 selectors checked, 323 metering failures and 1334 potential faults found on visual inspections.*

*MIP 3 (February 1979)*
*Provision of a Barred Calls meter on Non-Dir International Registers to detect, in the main, fraudulent use of ISD from Coin Collecting Boxes.*

*MIP 4 (July 1979)*
*Concerns various checks and modifications to tariff and associated clock equipments at MNSCs (CSUs, ND GSCs, TXK1 GSCs and SSCs).*

*MIP 5 (May 1979)*
*Concerns various checks on Multiphase Pulse Supply equipment (MPPS) at Local exchanges of Strowger, TXK1, TXK3, TXE2 and TXE4 types.*

Finally, in *MN 7* you were told 'it's the meter that counts' – let's not forget what makes it tick.

Sv6.5.6 (01-432 9453)

# International direct dialling (IDD) performance—'PIP17' and onwards

by **Jim Walters** ETE/ET10.1.1.2

**As the telephone network becomes more automated, customers naturally expect an improved service. This applies equally to users of the inland network and, with the expansion of IDD, to those making international calls particularly those incoming to the UK – this is where Plant Improvement Plan (PIP) 17 will help.**

## Measuring Quality of Service(QOS)

On the inland network it has been the practice in the past to measure QOS from Telephone Service Observations (TSO). For the future, Measurement and Analysis Centres (MAC) – mentioned in *MN 11* – will perform the processes of measurement and control using an automatic program of test calls. Various PIPs have been introduced over the years to achieve the required control of QOS and, until the MAC installation programme is complete, the use of PIPs will continue. On the international scene, arrangements have also been made for a programme of test calls over the UK network into the UK International Switching Centres (ISC). For services incoming to the UK – until MAC is in use – it has been decided to implement PIP17.

With PIP17, test calls will be sent *via* the International Switching Centres (ISC) to national (UK) test numbers, giving an idea of the performance of both ISC and the inland network as experienced by distant administrations.

## Purpose of Plan

Of all the ISCs, only Mondial and De Havilland have the capability of fully monitoring the QOS performance into the UK network, although all can measure through the ISC and outwards into the international network. Limited information – from TSO's at Mollison ISC – is available about the performance of the UK network itself as seen by international calls. Consequently it is difficult to assess the overall performance of ISCs and the associated inland network used for incoming international traffic. This leaves the PO dependent to a large extent upon the complaints and reports from other Administrations for an indication of the incoming performance. Also, any delay in identifying and dealing with incoming problems results in loss of revenue and poor customer PO relations.

The purpose of PIP17 is to provide performance information in a standard form to identify

- faulty circuits
- faulty equipment
- areas of congestion in the ISC
- areas of congestion in the inland network.

## How PIP17 will be implemented

Basically, the plan is to send a programme of test calls from the ISC to local exchange test numbers in the inland network, using a *TRT119* modified to provide fault print-out.

*PIP17* is being implemented in two stages as follows:

**Stage 1** – Equipment has already been installed in Mollison, using the *TRT119* without any special interface, to access one incoming line relay set in the outgoing unit. By using special codes, calls can be routed to any of the three international signalling systems used in the Mollison incoming unit. A tape with 80 inland network destinations has been produced, and the measurement programme started.

**Stage 2** – is expected to be fully operational by the end of this year. Calls will be sent from the *TRT119,* via an International Signalling System Interface Unit (ISSI) and a dedicated circuit, to the ISC on which the test calls are to be originated – Figure 1. The advantage with this system is that all ISCs will be monitored from a central point. The calls will be originated on the international side of the ISC in the various signalling systems used, and therefore appear as if they have been originated by overseas administrations.

**Note:** *The ISSI is used to convert loop/disconnect 2-wire dialling impulses into any of the present 4-wire international standard signalling systems, permitting the TRT119 to be coupled to the incoming international side of an ISC.*

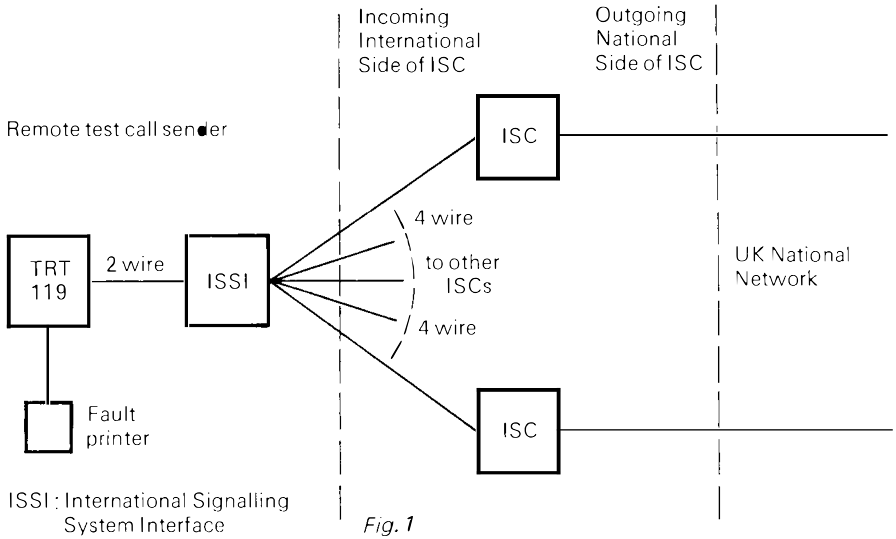



*Fig. 1*

**Test Programme**
With Stage 1, a monthly performance measurement will be taken from about 5000 calls sent over a period of 8 or 9 days during the hours of 08.00 to 18.00. The test call programme will be constructed using traffic data obtained from the ISC's, they will be traffic weighted, and sent to as many destinations as practical.

Using the same criteria as a basis, during Stage 2 a monthly performance measurement will be taken from about 1000 test calls per month per ISC.

Additionally, a programme of maintenance test calls will be run to locate problem areas highlighted during the performance measurement programme These calls will not interrupt the monthly runs. Alternatively, after completion of the measurement run, the maintenance programme can be run during the remainder of the month for fault location purposes.

**Results**
The printer associated with the *TRT119* will record all call failures, and a summary of each ISC performance. This will assist THQ, Regions and other inland centres to identify problem routes and problems within the ISCs.

The day-to-day running and analysis of the measurement and maintenance programmes will be the responsibility of local management, but general responsibility for call failure investigations as a result of PIP17, will rest with ETE.

**. . . and Onwards**
Two MAC test trunks will be provided from the LTR/NW MAC at Colindale Sector Switching Centre, one to the Stag Lane complex and the other to the Mondial House complex. At each of these, an ISSI/Access control unit will work to remote relay sets at up to a total of 5 ISCs – Mollison, De Havilland and Wood Street from the Stag Lane ISSI ; the others from Mondial ISSI.

For the purposes of the MAC system, the ISCs are designated as incoming GSC's. Using Test Sequence 5, MAC will pass test calls to the UK network. These hypothetical GSCs will be regarded as being in a separate 'Area'. Results will be printed out for the existing NW Area and the ISC 'Area'. As no hold-and-trace sequence will be run for this Area, co-operation between the MAC and ISC co-ordination points will be minimal. This means that NW Area MAC will have to advise the ISC Area of performance difficulties, and provide all fault and route analysis information. The ISC Area will then be responsible for solving any problems, which will probably entail using the Stage 1 and 2 methods of PIP17. It is hoped that the ISC Area will be connected to the NW Area MAC at the end of 1980.
ETE/ET 10.1.1.2 (01-353 9776)

# Seven, fifteen, twenty-three.....?

by **Dave Popham,** Sv5.3.5

**The teleprinter 7 family of machines is still serving our customers after more than forty years, although in ever-decreasing numbers. The teleprinter 15 has taken its place during the last ten years, with some 80,000 in service. The teleprinter 23 (referred to in MN9) will appear shortly on telex and on a few private circuits to test customer reaction.**

Where do we go from here ?

Preparations are well advanced to ensure that the PO is in a good position to improve and extend the facilities offered to 'hard copy' customers.

Firstly, we shall be adding a further, rather more impressive, member to the teleprinter 30 family of electronic machines – the Teleprinter No 31. Whereas the No 30 is a simple receive-only machine used either as a monitor machine, or as a terminal machine on private circuits not requiring an answer-back, the No 31 is a fully-comprehensive terminal.

Basically, it is a keyboard send/receive machine which incorporates an 8000-character electronic store. By adding an 'Attachment 1A' – a tape punch and reader – it becomes the equivalent of an auto No 15 but with considerably greater flexibility. A further option is a Visual Display Unit (VDU) which sits on top of the terminal and can be fitted as well as, or instead of, the tape unit.

The whole terminal is controlled by a microprocessor which can be programmed to give the customer a very wide range of facilities. The machine performs all its local functions at 30 characters per second. On-line speed is determined by the line capability. The print unit – the same as on the teleprinter 30 – is a matrix unit capable of producing two different character sizes – small for local copy and large for incoming messages. These will be printed out normally, and can be stored internally – for transfer to tape for permanent storage, or re-transmission. Material can be prepared 'in local' using the electronic store which, with the aid of the VDU, permits text to be edited. Mistakes can be deleted and insertions made at any point by typing in special codes, which cause the terminal to search its store to find either the beginning of a complete message, or any particular point in the text. When the edited text is satisfactory it can be sent to line, or printed out for local reference, or punched into tape for later transmission

The print-out can also be used instead of the VDU for editing purposes but not so readily

Like the teleprinter 30, the 31 is quiet and styled to fit in with modern office environments : figure 1 shows the No 31 fitted with tape unit and VDU. The No 30 is already available nationally, and the No 31, with tape unit only, will soon appear on private circuits in three Regions to test customer reaction. The VDU version will be trialled a little later.

Teleprinters 30 and 31 are 5-unit code machines. A 7-unit code machine, the Transtel B208L, is already in PO maintenance and is shown in fig 2. This is a plain keyboard send/receive machine with no memory and is used as the standard input/output terminal for control of SPC PABX's. It is also used in-house in Measurement and Analysis Centres.

## Facsimile

In addition to these new teleprinters, shortly the PO is to market trial a completely new service – document facsimile. Known as 'FONOFAX 200' two terminals will be offered – the 201 for light duty and the 202 for medium duty – see Fig 3 and 4.

With facsimile transmission, an original document is scanned and the contents converted into electrical signals which are used to modulate an audio frequency carrier. The resulting signal is transmitted over a telephone line to the receiving terminal. Here, the incoming signal is used to control a similar scanning process and to produce a 'facsimile' of the original document. No operating skill is required – merely the knowledge of how to load paper into the machines.

Both the FONOFAX 201 and 202 are drum-type machines ; that is, the original document and the receiving copy paper are wrapped round a drum for each message. A telephone call is made from the sending


*Fig. 1 – Teleprinter No. 31 with tape unit and VDU*


*Fig. 2 – Transtel B208L*

end to the receiving station and, after making sure the receiving machine has been loaded with paper, both operators switch over to 'Fax'. The sending machine transmits a phasing signal which sets the drum of the receiving machine in phase with that of the transmitting machine: transmission then starts. On completion of the transmission – which, on these machines, takes 3 minutes for a sheet of A4 size paper – the line reverts to 'telephone'. When satisfactory reception has been confirmed, the call is terminated.

The introduction of a heavy-duty machine, which will be roll-fed and capable of unattended reception, is also being considered.

Although the present population of electro-mechanical machines will continue in service for many years, more new types of terminal will soon be brought into PO service both in the teleprinter and facsimile fields.


*Fig. 3 – Fonofax 201 machine*

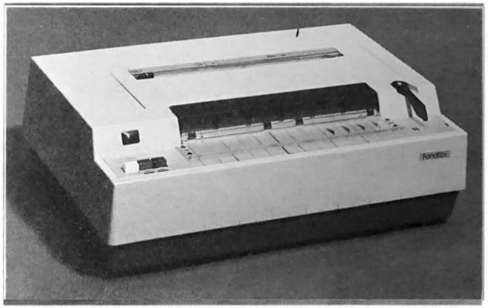



*Fig. 4 – Fonofax 202 machine*

We must keep abreast of technological development and offer customers a full range of services : from the relatively cheap and mundane – which is what most of them want – to the more expensive and highly sophisticated types which some customers need and are ready to pay for. Equally, we need to provide efficient and economical maintenance for these services and this is the challenge that now faces us – to continue to provide high quality maintenance, but for a wider variety of terminals.
Sv5.3.5 (01-432 9178)

# TXE2 isolations

by **Paul Smith** Sv6.1.3

**We first wrote about 'Troubles with the TXE2' in MN4 when there were 500 TXE2's in service. Now, after 10 years, about 1100 such exchanges exist. In that period over 550 failures have been reported, causing isolations and restrictions of service – these still occur at a rate of one or two every week.**

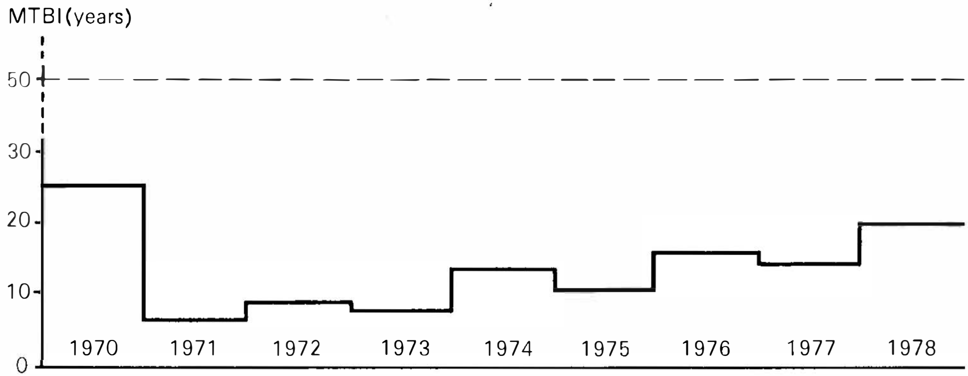
## Causes of TXE2 isolations

Although the causes of isolations are diverse, they have been found to fall into 3 clearly-defined categories :

- ☐ equipment faults – 50 per cent
- ☐ external cables, power supplies and working parties – 25 per cent
- ☐ fault not found (FNF) and cleared while locating (CWL) – 25 per cent

Because of their nature, faults in the second category were not used in assessing the reliability of TXE2 equipment itself. But it was disturbing to find that a quarter of all isolations were due to equipment faults cleared as 'FNF' – that is, with no identifiable cause or cure. Of greater concern is that faults in this category are increasing ; also there has been a steady rise in the average duration of isolations – from $\frac{1}{2}$ hour in 1970 to $1\frac{1}{2}$ hours in 1978.

Now, about those in the first category . . .




Combined performance of TXE2 exchanges 1970-1978 for all manufacturers' types

**Equipment faults** – detailed examination of isolations in this category showed that 70 per cent were caused by either a welded reed insert, a component fault, or a wiring contact. Other significant – but less prevalent – causes were mechanical failures, security changeover deficiencies, lightning damage and mains induction.

Each major cause of failure during the 10 year period was analysed on a year-by-year basis. This revealed two interesting trends.

- the distribution of isolations caused by both welded reed inserts and other components peaked in 1973, followed by a 'satisfactory' decline
- an apparent correlation between the type of fault and the vintage of the equipment.

A closer examination of the link between equipment vintage and isolations showed a peak of events between 1971 and 1973 – and an encouraging reduction in events on equipment installed from 1974 onwards. This pattern can be seen in the graph which illustrates the combined performance of all TXE2 exchanges.

### Objectives

THQ lays down standards for the quality of service for all UK telephone exchange systems. The 'loss of service' standard is known as the *mean time between isolations* (MTBI). For all analogue (ie non-digital) telephone exchanges with integral common control equipment, the MTBI is 50 years. Although there is some way to go before the design MTBI for the TXE2 is achieved, current performance calculations indicate that steady progress is being made towards this objective.

### The way ahead

Much use has been made of the first decade of field experience and public service, to ensure a steady improvement in the quality of TXE2 production equipment. As a direct result, customers are experiencing a better quality of service. With the continuing assistance of field staff in identifying and overcoming the system deficiencies, there is every reason to expect a further decline in the rate of exchange isolations.

Only then will customers experience the desired trouble-free service. But there is no room for complacency, and THQ will be monitoring events closely for further indications of weakness.

Our task will be greatly assisted by comprehensive and accurate reporting of exchange isolations or restrictions of service – and by an attack on those FNF and RWT's. Sv6.1.3. (01-739 3464 Ext 302)

# MF4 at TXS

by **Alan Wood,** Sv6.5.6

**The increasing demand for push-button telephones from customers served by Strowger exchanges (TXS) has led to the introduction of a new interface unit. This unit – known as the Signalling Unit 43A – allows the multi-frequency signalling system MF4 to be used.**

With MF4, each push-button depression on the telephone key-pad causes a discrete combination of tones (1-out-of-4 + 1-out-of-4) to be sent to line. The new unit – which is associated with 1st group selectors at non-director Strowger exchanges, and C1st selectors at director Strowger exchanges – is able to deal with both loop-disconnect pulses from rotary dials as well as MF4 signals from push-button phones. In the loop-disconnect mode the signalling unit appears transparent, while in the MF4 mode the unit retransmits the signals as loop-disconnect standard 2 :1 ratio pulses.

The signalling unit being used initially, consists of three printed circuit boards enclosed in a small metal box. Units are fitted into specially designed shelves mounted either on a relay-set rack or on the selector rack immediately behind the shelf of selectors they serve.

A plug-and-socket arrangement extends the input, output, power and control leads from individual signalling units to connecting blocks at one end of the mounting shelf.

Busy links and test jacks are also provided at the same end. From these blocks the units are cabled away to the equipment IDF for cross-connection to their associated circuits.

Basic functional tests of the unit can be made using a test box. However, for general performance tests a microprocessor-based monitoring unit has been designed.

This has been programmed to register the hold times of MF calls, and to extend an alarm when the average hold time falls below a pre-set value. But the final monitoring arrangements are now being reviewed pending reassessment of the facilities.

It has been found that a harmonic of the 50 Hz dial tone can affect the receiver circuit in the signalling units – causing wrong numbers. To reduce this risk, a new dial-tone generator, producing a tone of 350 plus 440 Hz, has to be installed at any exchange where the MF4 facility is provided.

A national programme for installing these new units has been formulated but their introduction may be delayed because other problems have been uncovered by the current trial.

Sv6.5.6 (01-432 1342)

# Type approval of customers' PABXs

by **Roy Burrows** Sv5.2.3

**It is 10 years since the first customer-owned, PO maintained, common-control PABX came into service. Of the variety of types now available, the PO has approved twelve for connection to the public network. This article gives an insight into the methods currently used for type-approval evaluation, and how these will be adapted for the newer Stored Program Control (SPC) systems.**

We have studied 23 of the 27 different PABX systems offered to the PO for type-approval evaluation. So far, 12 have been approved and the rest are currently under assessment. Equipment categories have been of crossbar, rotary switch, code switch and reed designs, although one SPC system (the IBM 3750) has been approved. We expect that most, if not all, future evaluations will be of SPC PABX systems. Any new PABX system offered to customers by suppliers must be approved by the PO as suitable for connection to the public network. It also has to conform to standards of security, reliability and maintainability – prescribed in documents called Post Office Requirements (PORs). These are aimed at ensuring that customers are offered an acceptable standard of service with PO maintenance costs being kept within bounds. To make sure these standards are met, the PO evaluates all new systems before considering the granting of type approval. While this evaluation is being made, the sale of the PABX is limited to an agreed number of customers.

## System performance

How do we measure this?

Primarily, by determining how much the system costs to maintain, and its fault rate. Fault rate is used as a measure of reliability, and maintenance costs – including labour, spare parts and maintenance aids – as a measure of maintainability.

Performance is evaluated from surveys of PABX maintenance records at selected trial installations. Using an on-site register, a copy of which is sent to THQ, maintenance officers record details of each separate maintenance activity undertaken, such as: faulting, filing diagrams, ordering stores, co-operating with manufacturers' engineers and so on. Apart from dates and times, entries are made using codes particular to the PABX type, and include

- reason for activity
- equipment and component worked on
- fault and clear action
- effective on-site maintenance time spent.

Ineffective and travelling time is excluded from the maintenance time figure, so as to give a true result independent of differing local circumstances.

**Approval time**
The time taken to evaluate a PABX can vary from between one and five years. Few systems are fully compatible with our network initially, or with our performance requirements. The PO spends a great deal of time and effort evaluating these systems, and during this period many of the 'bugs' are ironed out. This is evident from the number of modifications carried out before a system is given approval.

**Comparability**
Our surveys show considerable variation in fault and manhour rates for similar systems, so the figures have to be treated with caution. Factors influencing results include: uncertainty about the numbers of lines connected to a PABX, time booked to the wrong works order numbers, or inconsistencies in recorded effective time. For example, it appears that some staff do not record all the effective work done, whereas others, who spend the whole of their time at large PABXs, seem to count all their hours as effective.

Accurate recording is important in system assessments, so if our procedures are difficult to operate, we would like you to tell us so.

**Future studies** will be mainly on SPC PABXs and a different method will be used. This is because the maintenance procedure consists of changing faulty plug-in units (PIU). The new pattern of maintenance means that future surveys will not require data recording in coded form, so fewer errors are expected. *T/E5 D0011* introduces a new A5846 form which will be used for determining PIU fault rates and replacement costs.

**Systems studied**
The table lists the PABX studies conducted to date. We plan to deal with four new SPC systems over the next two years (the Plessey PDX, GEC SL-1, Pye-TMC EBX 8000, and STC Unimat 4080) and studies have already begun using the new method.

| PABX type | Manufacturer | Switching equipment | Number of installations studied | Study period (years) | Current evaluation position |
|---|---|---|---|---|---|
| ARD561 | Ericsson | Crossbar | 24 | 3 | Approved |
| ARD562 | Ericsson | Crossbar | 8 | 4 | Approved |
| AKD791 | Ericsson | Code switch | 10 | 3 | Approved |
| AKD792 | Ericsson | Code switch | 5 | Continuing | Under evaluation |
| AKD793 | Ericsson | Code switch | 2 | Continuing | Under evaluation |
| P200 | ITT (STC) | Crossbar | 5 | 2 | Approved |
| P1000T | ITT (STC) | Crossbar | 5 | 4 | Approved |
| P1000T-2 | ITT (STC) | Crossbar | 3 | 3 | Approved |
| P1000CT | ITT (STC) | Crossbar | 8 | 3 | Approved |
| UH200 | PYE/TMC | Rotary | 3 | 2 | Approved |
| UH900 | PYE/TMC | Rotary | 5 | 2 | Approved |
| UH900 (EXTENDED) | PYE/TMC | Rotary | 1 | Continuing | Under evaluation |
| PB480 | Plessey | Crossbar | 18 | 5 | Approved |
| PB8000 | Plessey | Crossbar | 8 | 5 | Approval imminent |
| PB1000 | Plessey | Crossbar | 8 | 2 | Under evaluation |
| REX80 | GEC | Reed | 11 | 3 | Approved |
| REX80E | GEC | Reed | 1 | Continuing | Under evaluation |
| 3750 | IBM | Solid state | 18 | 5 | Approved |
| AKM303 TANDEM | Ericsson | Code switch | 5 | 5 | Under evaluation |
| TSC4761 TANDEM | ITT (STC) | Crossbar | 3 | 4 | Under evaluation |
| PT100 TANDEM | Plessey | Crossbar | 5 | 4 | Under evaluation |
| PT6000 TANDEM | Plessey | Crossbar | 1 | 1 | Under evaluation |
| RCMU TANDEM | Plessey | Motor Uniselector | 3 | 4 | Under evaluation |

Sv5.2.3 (01-739 3464 Ext 7722)

# Monarch 120—A new call connect system

by **Len Hobson,** Sv5.3.2

**The PO is introducing a new PABX – formerly known as the CDSS1 (customer digital switching system number 1) and marketed as the Monarch 120 call connect system. It will enter service on a limited basis in selected regions during 1980.**

Since the present range of Strowger-type PO-rented PABXs was introduced in 1952 – including the PABX 1, 2, 5, 6 and 7 – the needs of most customers wanting up to 100 extensions have been met. Now, the Monarch 120 is aimed at satisfying the changing requirements of our customers.

## Advanced technology

The Monarch 120 uses pulse code modulation (PCM) techniques for speech transmission, time division multiplexed (TDM) switching and microprocessor control. The stored program control (SPC) feature provides for a wide range of optional customer facilities in keeping with the larger proprietary SPC PABXs now available. The main features are:

- TDM Speech and Signalling
- Microprocessor SPC
- Modern technology, high reliability
- Modular construction, small physical size and easily maintainable
- Silent operation
- Wide range of facilities, some under customer control
- Choice of dial or MF4 'phones

The equipment cabinet, which is no larger than a 4-drawer filing cabinet, contains a control shelf, power unit, and 5 line-unit shelves each with space for up to 24 extensions, 6 exchange lines or inter-PBX lines, and 2 auxiliaries. Auxiliaries may be MF4 receivers, console line card, or optional facility circuits such as paging or fast FAX. The maximum system capacity is governed by the available shelf space of 256 ports and would normally be:

120 extension lines
40 trunks and auxiliary circuits (proportioned as required)
1 Conference unit (occupying 32 ports)
1 Tone generator (occupying 32 ports)
1 operator's console (occupying 2 ports)

The remaining ports are available for special purpose equipment or system expansion.

An attractive feature of the Monarch 120 is the low-profile operator's console.

matching the new range of telephones. It includes a microprocessor, Visual Display Unit (VDU) and capacitive 'touch-sensitive' keys, which enables the console to act like a control teletype. For example, the operator can instigate changes of extension, class of service, extension numbering and obtain fault information.

## PO development

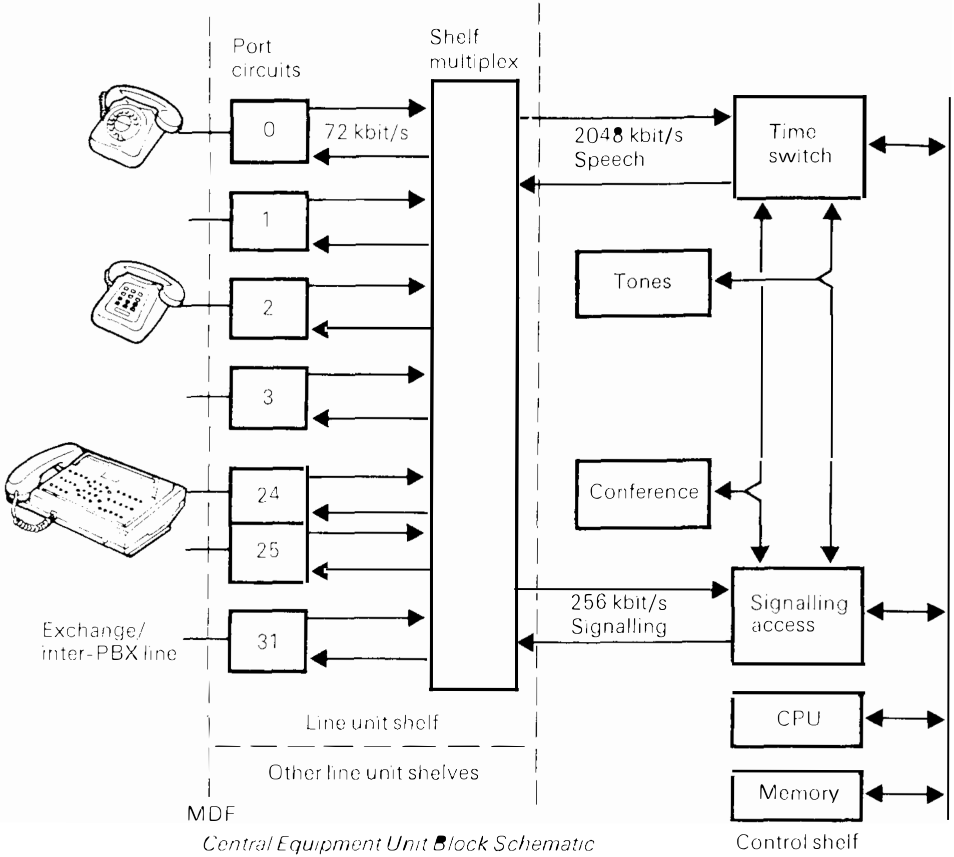
The Monarch 120 was developed jointly by the PO Telecomms Development and Research Departments of THQ. Early feasibility studies indicated that the TDM approach would be successful, and arrangements were made with Plessey and GEC to cooperate with the PO in production engineering the new system.

## Digital operation

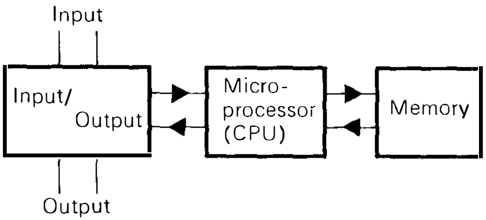
Speech samples are taken every 125 micro-seconds and digitally encoded using the 'A-law' (European standard) PCM method. After being routed to their destination by means of a single (digital) switching stage, the signal is decoded to recover the original signal. Each line circuit (or port) incorporates its own PCM coder/decoder (known as a codec) which generates a 9-bit digital signal at each sampling interval, comprising 8 speech bits and 1 signalling bit. This signalling bit forms part of another 8-bit code giving each port a useful means of signalling, which may be used in the future for other purposes. For example, possibly to provide a digital signal to the extension instrument similar to the data link between the operator's console and the central equipment.

The 64 kbit/s coded speech plus the 8 kbit/s signalling from each of the 32 ports are fed via 72 kbit/s shelf multiplexers, converting them to 2 composite serial data streams. One of these is for the speech (2048 kbit/s) and the other for signalling (256 kbit/s). From there, the data streams, together with those from the other line unit shelves, are passed to digital switch and signalling access cards in the control shelf.

The digital switch converts the composite signal from serial to parallel form. The speech




*Central Equipment Unit Block Schematic*




*Microprocessor SPC system – simplified*

samples from each of the 256 ports are fed via an 8-wire highway into a 256 x 8-bit read-write memory. This memory therefore temporarily holds a speech sample for every port in the system. The contents of this speech store are read out during the time-slot associated with the destination port and a connection established through the system. The destination addresses are held for the duration of the call in a separate memory known as the connection store, directly accessed by the CPU. The signalling highways are multiplexed and stored in a similar way to the speech highways. The use of a parallel signalling path improves traffic handling because all ports can be signalled separately from speech regardless of the network state.

The shelf multiplexer also serves to demultiplex signals in the reverse direction.

## Control by stored program

As already mentioned, the Monarch 120 is based on an SPC system. This means it depends for its working on the use of a stored program. The orderly use of this program is controlled by a microprocessor which itself depends on information stored in memory. A simplified representation of a micro-processor system is shown in the figure. The information stored in memory may represent either:

- instructions – coded pieces of information that direct the central processing unit (CPU) to perform certain activities
- variable information processed by the CPU.

It is this stored information – or stored program – in conjunction with associated software (alternative programs) which makes the Monarch 120 so flexible in operation, in available facilities and self-diagnostic maintenance aids.

## Watchdog aids maintenance

Using a number of inbuilt features, the Monarch 120 is able to monitor its own performance and produce fault finding data for maintenance staff. These aids are known as the Maintenance and Diagnostic (M & D) Package, which enables fault location down to plug-in unit level. The prime monitoring function is provided by the 'Watchdog' – a device which is kept inactive by pulses from the CPU every 100 ms. But, if these pulses fail to arrive – indicating a fault – action is taken automatically to restart the program. A pre-set number of attempts at re-starting is made before a 'drop-back' condition is invoked. This is a state where DEL facilities are given only to a limited number of extensions. Dropback also occurs in the event of mains power failure. It can also be invoked, if required, during maintenance, when a special range of 'off-line' tests is available – using the CPU to check other parts of the system.

While the Monarch 120 is working normally, an automatic routine of back-ground tests is run every 15 seconds. During each test cycle, the control shelf and a number of ports on the line shelves are tested. The line shelf ports are tested progressively so that all ports will have been tested after a set number of test cycles. These tests may also be initiated manually whereby, following a pre-determined routine, the maintenance officer can use an On-Line Diagnostic facility to initiate specific tests and monitor the results. This monitor may be either a hexadecimal display in the cabinet, the VDU on the operator's console, or a teletype. The console VDU and teletype may also be used to list a fault record providing the maintenance man with initial information indicating which diagnostic tests to run. .

Field maintenance procedures are to be developed and finalised during the system field trial beginning in August 1979. It is intended to outline these and to give details of in-service experiences in a follow-up article.

Sv5.3.2 (01-432 1385)

# Keeping the wheels turning

by **Bert Thomas,** OP4.2

**Satisfying the motor transport (MT) needs of the Telecomms Business is an onerous task. MT often shares the back-stage with heating, power plant, factory equipment and so on, leaving the spotlight and publicity to the more glamorous Telecomms apparatus. In this article some light is thrown onto the maintenance responsibilities and organisation of the MT specialism.**

Efficient maintenance of the telecomms system as a whole, depends on a well-maintained motor transport fleet. This is the task for nearly 4000 staff in 323 MT workshops. Between them, they carry out maintenance work on 50,000 telecomms vehicles and trailers, 6000 vehicular mechanical aids and trailers, and over 24,500 non-vehicular mechanical aids. As well as giving a service to the Telecomms Business, the ever-increasing legal requirements have to be satisfied. Safe and roadworthy vehicles have to be provided for the users and, as a consequence of their use on the highway, the general public must be safeguarded.

The policy is to carry out all maintenance work in PO MT workshops, their size and staff numbers depending on the size of the local fleet. MT staff in each Region come under a Regional MT Officer (RMT.O) who controls the work in the field through technical assistants. It is the RMTO's responsibility to see that GMs are provided with the correct vehicle at the proper place at the right time, with a minimum of downtime, giving a high priority to safety, with all these factors achieved at a minimum of cost.

There is also an element of agency work performed on Postal vehicles by Telecomms MT workshops, and *vice versa*.

The table shows the schedule of maintenance, where the frequency is based on the principle of preventive maintenance backed up by drivers' reports. The 1968 Road Transport Act requires that a satisfactory maintenance policy is in operation, supported by adequate records – otherwise the all-important Operator's licence will lapse. These requirements are also backed up by an annual inspection of vehicles under the plating and testing regulations.

The aim is to achieve a reasonable compromise between the level of serviceability and the cost of providing it. We do this by using a realistic scheduled work programme supported by the use of reserve vehicles.

## Feedback is important

A comprehensive system of recording maintenance information is used and this is linked to a management information scheme. Detailed maintenance policy is set by THQ and conveyed to regional staff through TIs. Maintenance methods are investigated, particularly when new models are introduced into service, to ensure that the correct tools are available to enable workshops to maintain vehicles and mechanical aids efficiently.

A reporting procedure also exists whereby MT staff can tell us about any special reports received or unusual faults encountered. Safety items such as brakes or steering are given high priority attention. Details of claims under guarantee are also forwarded to THQ. From this information the maintenance group can detect potential epidemic failures. Evidence from these sources is used to negotiate with the manufacturers for design changes and modifications.

Details of modifications and other information which is likely to be helpful to workshops is published in the form of MT Service Bulletins.

## Accommodation and staffing

While the RMTO is responsible for day-to-day fleet maintenance, THQ carries out other planning support and advice functions. These include accommodation and staffing levels.

Standard drawings for workshop layout have been produced by THQ after joint consultation with POEU at national level, and field staff. Workshops come in five layouts according to size and type of fleet. In most Regions all maintenance is carried out in the town workshop unless it is economic to centralise certain types of work such as bodywork. LTR has a special problem in finding suitable accommodation in central London, so has a large central repair depot for its major repair work.

The guideline on staff levels consists of a Work Unit factor which is related to the various types of vehicles. This factor is applied to the number of vehicles of that type and, when summarised with all the types in an MT Workshop, gives the total staff required. The RMTO relates this standard figure to local conditions and decides on the necessary manning level. The number of MT staff has stayed relatively constant, even though the number of vehicles has grown considerably. One factor that has influenced this is that the more modern vehicles need less maintenance. The use of self-service pumps and automatic washing machines has also relieved MT Workshop staff of a good deal of ancillary work.

At present a study is being made into the productivity in MT with a view to identifying areas where improvements can be made. This includes an examination of existing maintenance policy and workshop practices. OP4.2 (01-432 5758)


Maintenance policy

| Vehicle group | Scheduled maintenance | Telecomms vehicles |
| --- | --- | --- |
| 1 Up to and including 15 cwt (inc. passenger cars) | Safety check | – Every 1000 miles or 2 months, whichever is earlier |
| | Full inspection | – Every 3000 miles or 6 months, whichever is earlier |
| | Annual service | – Every 12 months* |
| 2 Over 15 cwt (except supplies division vehicles) | 2.1 Low mileage vehs | – Less than 6000 miles/year |
| | Safety check | – Every 1000 miles or 2 months, whichever is earlier |
| | Annual service | – Every 12 months* |
| | 2.2 High mileage vehs | – Over 6000 miles/year |
| | Safety check | – Every 1000 miles or 2 months, whichever is earlier |
| | Full inspection | – Every 3000 miles or 6 months, whichever is earlier |
| | Annual service | – Every 12 months* |
| 3 Supplies division vehicles | Safety check | – Every 1000 miles or 1 month, whichever is earlier |
| | Full inspection | – Every 3000 miles or 3 months, whichever is earlier |
| | Annual service | – Every 12 months* |

* To coincide with the annual DTP test – the vehicle to be put in such a condition that no major work is to be expected during the next 12 months.

# The negative impedance repeater—PART 2

## Problems on junctions incoming to TXK1 exchanges

by **John Ford,** SETR

**The need to ensure that junctions are planned within the laid-down limits, was covered in MN14. Some factors which could contribute to service problems were also outlined. Here, two examples are mentioned of actual problems involving Negative Impedance Repeaters (NIRs) on routes incoming to TXK1. Possible cures are also examined.**

**Example 1** Strowger GSC to TXK1 Local – Digit Splitting.

Reports of wrong numbers being received incoming to a TXK1 were investigated. The cause was found to be 'splitting' of the first digit received at the TXK1. Further tests, using a Trunk Calls Destination Analyser at the GSC, proved the pulses were not mutilated before being sent to line. Checks at the TXK1 showed that the CD relays in the incoming TRGs were OK (this is a known cause of digit splitting). One suspect item remained – the junction.

The circuit advice showed 0.63 mm cable

| | |
|---|---|
| resistance | 1500 ohms |
| NIR | 220 ohms |
| Total | 1720 ohms |

The circuit limit was 1750 ohms – reduced from 2000 ohms due to the capacitor bridge in the incoming TRG. So, what was wrong?

We remembered the golden rule: if there is an NIR at one end of a circuit it is almost certain there will be an attenuator at the other. Investigation revealed a 1 db attenuator with 150 ohms resistance in the signalling path. A further 50 ohms resistance was taken up by the pairs in the GSC, bringing the total resistance to 1920 ohms – 170 ohms over the limit.

It was decided to re-arrange these circuits onto 9 mm cable and remove the NIRs and attenuators. The digit splitting fault then disappeared. The moral to the story is: If you think you have trouble, measure the resistance between equipments – the circuit advices may be incorrect.

**Example 2** TXK1 Local – 08 Prints and Release Alarm Prompts. The fault conditions mentioned, and reports of loss of incoming calls, prevailed for a considerable time before the problem was associated with a selection of incoming junctions, all of which had NIRs connected to them.

Investigations revealed that on the clear-down of a call, the A relay in the incoming TRG flicked which initiated a partial reseizure. A new call being established ended up with two select magnets held in the register connector instead of one, causing the call to fail.

A test was made by manually operating and releasing a TRG A relay. It was noticed that the relay re-operated one or more times. It appeared that a pulse bounced back and forth along the junction between the TXK1 TRG and the 2 $\mu$F capacitor in the NIR at the GSC, until such time as it decayed. Removal of the NIR from circuit suppressed the phenomenon; a 2 $\mu$F capacitor inserted in its place caused it to return.

### The UK inland network

The NIR was designed primarily for use with 9 mm cable, but it has also been used extensively throughout the country on 0.63 mm cable. Because of the distances between towns and villages in the UK, and the 3db junction standard, it is frequently necessary to amplify circuits by a relatively small amount. However, this conflicts with the fact that the NIR and its associated capacitor frequently takes the circuit outside the limits of 1750 and 2000 ohms laid down by the PO and a manufacturers quoted capacitive limit of 3.5 $\mu$F.

### Possible cures

The problem may be overcome by:—

- ☐ Changing the circuits to 0.9 mm cable. In many cases, because of the length of junctions involved, this will produce circuits of acceptable loss values without amplification.
- ☐ Reducing the capacitance of the NIR.
- ☐ Using a hybrid-type 2-wire repeater; this costs 4 times as much as an NIR but has a lower capacitance.

### The future

A new NIR, which obviates the need to use a 2-wire attenuator when low gain settings are required, is being trialled by THQ. It is hoped also to be able to reduce the capacitance to below 2 $\mu$F, thus overcoming the TXK1 incoming junction problem. A test carried out with a modified NIR on one junction to a TXK1 has proved satisfactory.

In the long term, however, it may be that the implementation of 30 channel PCM will overtake further development of the NIR, resulting in a few more years of 'signalling difficulties' on loop/dis junctions before the digital era comes upon us.

SETR/SM1.2 (0273 201734)

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# PO high-voltage sub-stations

by **Colin Dugdale,** SWTB/Sv1.1.4

**Here, we outline the use of High-Voltage (HV) Supplies in the PO and the procedures for working in an HV sub-station. A later article will deal with some of the problems introduced by HV supplies and possible ways of overcoming them.**

## Basis of HV supply

The general policy applied by the electricity supply authorities is that a total load up to 750 kW can be taken from the low voltage (up to 1 kV) network, but loads greater than 750 kW are supplied and metered at 11 kV. The tariffs and 'unit' charges are marginally lower when the higher voltage supply is used. The PO naturally takes advantage of this at larger stations where the load exceeds 750 kW, and at others, too, where the loads are less than this and it is convenient for the supply to be provided at high voltage at the more favourable tariff.

The PO has used HV sub-stations for many years. Earlier, the Electricity Boards supplied installations at 6.6 kV, but 11 kV is now the standard.

The HV intake is fed from the 'Boards' ring system *via* a circuit breaker – known as a bus-section oil circuit breaker (OCB) – and is the metering point for the station.

## HV apparatus

The PO arranges to provide switchgear, protection equipment and transformers necessary to bring the 11 kV supply down to the normal range of 415V 3-phase to supply the station power plant and accommodation services loads.

The supply to each of the PO transformers is controlled by a PO OCB which is normally in separate accommodation from the 'boards' apparatus but, in some installations, shared accommodation is used.

Although some PO HV transformers are oil-filled and controlled by HV oil-filled switch-fuses, the majority are air-cooled and contained in metal cubicles. This is preferred because air-cooled transformers are lighter, the cubicles are compatible with other power cubicles, and it is not necessary to provide special fire precautions or oil catchment areas. Being lighter than oil-filled types, there are no floor-loading problems so, if necessary, they can be installed at different floor levels within buildings. Most are rated at 600 kilo-volt-amps (kVA) but some are rated at 1250 kVA.

For safety reasons, access doors on HV transformers have an interlocking system – associated with the PO OCB and the load output low-voltage switch. This ensures that supplies to the transformer are switched off before the doors can be opened, and that all doors are closed before supplies can be switched on.

## Control of work

Control of work on HV apparatus is laid down in the Factories Act Electricity Regulations. To comply with the Act, TIs E12 B7000 and E12 B7001 have been issued giving the organisation and procedures for work in PO HV sub-stations.

Each PO HV sub-station is under the control of an Engineer HV (AEE or above) who is responsible for issuing Authorities to Work and Supervision Authorities for work in the sub-station. He also has responsibility for preparing local instructions relevant to work organisation and practices for each sub-station under his control.

A system of certification has been introduced to control the work in HV sub-stations. The terms used are:

- **Authorised person HV (APHV)**
  This is a certificated TO (or above) who may direct and/or perform the operation, maintenance, testing or repair of HV apparatus as authorised in an 'Authority to Work', attend on work authorised in a Supervision Authority, and perform work authorised in local instructions.
- **Competent person HV (CPHV)**
  This is a certificated Technician 2A (or above) who may assist an APHV in work on HV apparatus. He may operate or perform work on it under the direction of an APHV and perform work for which he is authorised in local instructions.
- **Access certificates**
  These may be issued to personnel required to work in the sub-station on plant other than the HV apparatus.

Direct access to sub-stations is restricted to certificated personnel, and work done by non-certificated personnel must be supervised by an APHV. Sub-stations are locked and the keys kept in lockable key cabinets. A sub-station is normally opened by an APHV. However, local circumstances may make it necessary for alternative arrangements to be included in local instructions, so that other named persons may gain access to attend to non-HV plant in an emergency.

No person may work alone on HV apparatus, therefore all such work is carried out by an APHV accompanied by either another APHV or a CPHV. Work may be performed by a CPHV under the direction of an APHV.

**Training and certification**

Before receiving their certification to work in HV sub-stations, candidates are trained on working procedures by an Engineer HV. They are also given on-site training for the specific plant to be worked on. After training, they are tested by another Engineer HV to ascertain competence. Satisfactory candidates are issued with the relevant certificate, which gives the name of the holder, confirms the work for which the certificate is issued, and names the sub-stations concerned. The competence of certificate holders is reviewed annually.

Before specific work on HV apparatus can be done it must be made safe. An Authority to Work, issued by the Engineer HV to the APHV in charge of the sub-station, authorises this work. It also calls for the necessary preparatory safety precautions to be carried out. After that is done, the APHV issues a Permit to Work to the APHV in charge of the work (which may be himself) confirming that it is safe to work. To ensure safety, checks are made at each stage of the work on the Authority. If any doubts arise, work is stopped and the Engineer HV consulted. When the work is finished, the Permit to Work and the Authority to Work are completed and returned to the Engineer HV.

When non-certificated personnel need to work in a sub-station a Supervision Authority is necessary. In this case the Engineer HV authorises the APHV in charge of the sub-station to see that an APHV explains the work to be done and is present while it is being carried out.

A sub-station log book is used to record all visits and work done.

**Fire protection**

Automatic $CO_2$ fire extinguishers are provided in all HV sub-stations containing oil-filled equipment, if any doors lead to the main building. This protection is not necessary if the sub-station has only external doors.

Heat detectors, above the switchgear, trigger the output from the gas bottles which forces all the combustible air from the room in less than one minute.

However, this in itself would be a hazard to any person in the room when the extinguishers operated, as asphyxiation could quickly occur. To overcome this, a system of interlock controls associated with the access door, and warning lamps, are provided to prevent the $CO_2$ being discharged with someone inside the sub-station.

**Accommodation**

Because of the need for controlled access at all times, and special fire precautions at some installations, it is desirable to provide dedicated HV accommodation. When shared accommodation is used, though, many problems arise – some of which will be discussed in a follow-up article.
SWTB/Sv1.1.4 (0272 295563)

# Transit network performance

by **Duncan McMillan,** STB

It was intended initially that only a small amount (about 5 per cent) of subscriber trunk dialled (STD) traffic would be routed over the transit network – explained in MN 6. But in Scotland, due to its rural nature, transit facilities are used quite extensively. In fact, smaller group switching centres (GSCs) may, at times, route more than 65 per cent of the STD traffic over the transit network. It is not surprising, then, that the largest transit switching centre (TSC) outside London is in Glasgow.

To the GSC staff in Scotland, the quality of service (QOS) of calls using transit facilities is, naturally, of great interest. Service measurement by traditional methods failed to give a true picture, and it was suspected that the QOS on transit calls worsened at night or at weekends. To solve this, a 'service' meter has been added to the existing 'call count' and 'repeat attempt' meters. This permits a measurement of QOS, by sampling all the transit traffic, producing details of total calls, total repeat attempts and total failures in all Strowger and some TXK1 GSCs in Scotland.

Although this arrangement is intended to give some direction of maintenance effort, it is not generally achieved in practice for two main reasons:

- the meters have to be read at very frequent intervals
- high failure rates, measured on the service meters, give no indication of where or when the trouble occurred.

The diagnosis of meter readings is possible, but could involve most maintenance staff in much abortive testing, often failing to produce an improvement in QOS. A weekly reading of meters only provides a management statistic, and more frequent reading may increase the abortive testing to unacceptable levels. But as regular surveillance of the transit access equipment at GSCs is necessary, and congestion is already recognised as a major problem, any form of test call sending only exacerbates the situation.

## Introducing 'Asset'

It was in this climate that staff in STB developed the idea of an Automatic System of Surveillance Equipment for Transit (ASSET). The aim was to monitor live transit and international subscriber dialled (ISD) traffic, to 'flag-up' when trouble occurred and to identify the specific items of equipment failing on such calls. As a result, a common unit for director, non-director and TXK1 GSCs was developed in co-operation with THQ.

From the data it produces, ASSET enables call failure patterns to be established and faulty equipment to be identified. Also, some functional checks are made to identify suspect equipment, even on successful calls.

## Asset in director GSCs

Asset is mounted on a miscellaneous apparatus rack and is connected to:

- an 18-wire access highway, multipled to all multi-frequency sender-receivers (MFSR)
- a 30-wire register identity highway, multipled to all 6-digit store hunter (6 DSH) racks
- a 20-wire 8-digit store (8 DSH) identity highway, multipled to all 8 DS racks.

The progress of calls using MFSRs is determined by monitoring the DC signals on the control leads. A relay chain ensures that only one MFSR is connected to ASSET at any time. To obtain access to ASSET, the earth applied to the PC lead of a MFSR during seizure is extended, and an acknowledgement signal is returned on the ACR lead if ASSET is free. The 18-wire highway is then established between MFSR and ASSET. The identity of the MFST is determined by a particular access chain relay within ASSET.

To identify the register relay set, a signal is extended from ASSET during seizure, via the MFSR and associated 6 DS, and is encoded in a diode matrix associated with the 6 DS hunter.

This signal is extended onto 3 of 30 wires to indicate 'hundreds', 'tens', and 'units' digits, and returns via the register identity highway to ASSET.

In the event of an international call being made, the 8 DS is identified immediately it associates itself with the 6 DS. In this case the identity, in the form of 'tens' and 'units' digits, is extended on a 20-wire highway to ASSET.

The progress of a call, whether to another transit or to a terminal, is determined by signals on the D1 or DX leads. The A, B and C digits are extended in 2-out-of-5 form, checked in turn for correct encoding, converted into binary, and stored in relay stores 1-3. Should the call be routed through another TSC, the second set of ABC digits are temporarily stored in stores 4-6, compared with the initial digits and, if they correspond, are released to allow storage of further ABC digits or terminal digits. A counter is incremented by one each time a set of ABC digits are received, thus indicating the number of TSCs used in the routing.

Terminal digits are stored successively in stores 4-9 and a terminal counter is advanced by one for each DX signal received. Each DX signal detected is checked to ensure that the DX reed relay in the MFSR does not stick.

If, during monitoring, a fault is identified, or a clear-down signal is given calling for repeat attempts, all stored information is printed out. Regular analysis of ASSET print-outs allows early identification of faulty equipment which could otherwise exist within the network for several days. Catastrophic faults are highlighted remarkably quickly, and intermittent failures can be identified by maintaining an incident record. Experience with ASSET has brought out these benefits.

- Δ 24-hour surveillance of transit and ISD calls
- Δ directing maintenance effort to specific equipment
- Δ immediate indication of major problems
- Δ detection of call failures caused by intermittent or marginal effects, hitherto lost, ignored or undetected
- Δ avoidance of abortive testing of serviceable equipment
- Δ ability to readily observe any MFSR both audibly and visually
- Δ ability to identify common equipment instantly

The sample monitored is dependent on the calling rate and equipment holding time, but the prototype is currently averaging 100 000 calls per month – more than half of all the calls using MFSR facilities in the unit concerned. Since ASSET has been in use at this unit the QOS – as measured by the service meters – has improved by 50-75 per cent.

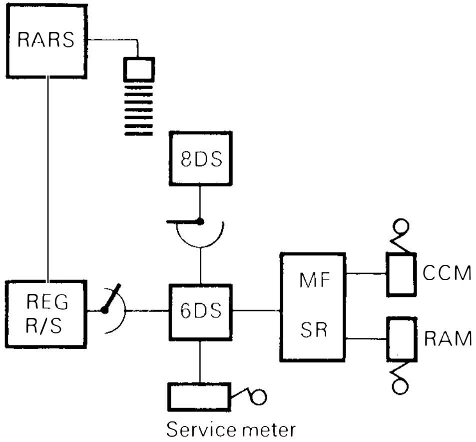


*Fig. 1 Service meter added to a director GSC*

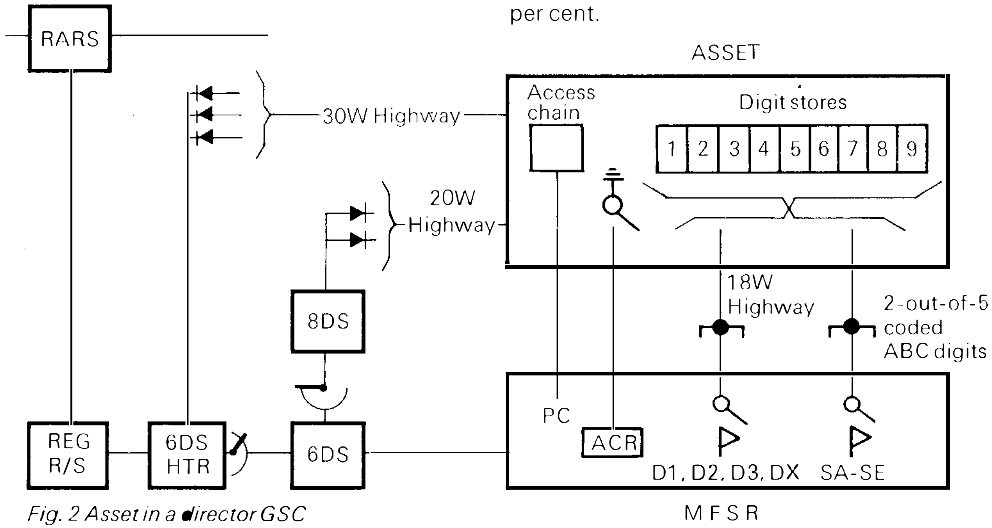


*Fig. 2 Asset in a director GSC*

**Advantages**
It cannot be claimed that ASSET will cure all ills in the transit system. But it can be stated that ASSET provides the only simple, easily-maintained, device which can detect and identify common equipment failures in GSCs, or route failures in the network, quickly and effortlessly. ASSET directs maintenance effort onto items of plant which have been consistently involved in call failures, and pinpoints faulty plant without the need for exhaustive test call sending programmes or meter analysis. ASSET provides the information needed to clear problems as they occur, provides a detailed record of failed calls to allow retrospective clearance, and provides the means to confirm that the problem has been resolved.

Until modern systems with a full equipment identification facility are provided, ASSET can automatically provide the identity and failure pattern of the transit access equipment used on unsuccessful calls

It is understood that it is national policy to use ASSET in director and TXK1 GSCs only, although – with the replacement programme for type 4 register-translators – it is unlikely that ASSET will actually be installed in any director GSC. Non-director GSCs have the multi-frequency test unit to combat these problems.

STB/S132 (031-222 2345)

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# Letters

**... on chamois leather**
Surely a synthetic material can be used nowadays for cleaning wiper tips or relay contacts, instead of using chamois leather?
R P Jarmy TO, Ilford North ATE

*Sv6.5.6 reply: Chamois is preferred because it contains a degree of natural lubricant, and has been used for many years in exchanges. We agree the cost is high and it is difficult to obtain good quality leathers but, so far, a suitable alternative has not been found. Weare considering supplying chamois ready cut into strips to ease problems with stocks. Incidentally, for the conservationists, 'chamois' leather has no connection with the deer family – it comes from the flesh-side of sheepskin.*

**... on computers – and jargon**
L Birch of Sheffield Telex Auto asks – '... because MN has exposed its readership to the depth and penetration of computers, I think an article explaining the various functions and roles of computers would be useful' and D J Evans on CA&L Maintenance in Lincoln TA asks – '... I would like some fairly general information on such subjects as digital switching, PCM, Codecs, modems, VDUs and so on'.

*Both these letters helped me in my editorial task where my aim is to publish articles which the majority will read and (hopefully) understand. The observant reader may note that this issue mentions all the subjects raised by the two correspondents and I hope, in a small way, that MN has helped.*
Editor

**'Subscribers'**
The MN14 editorial suggested we should all make a conscious effort to think of our public as customers rather than subscribers. Since 1972 the word 'subscriber' has been confined to legal and quasi-legal contexts. The word 'customer' has been encouraged in all other contexts. If this is not generally known, perhaps there is a case for a renewed publicity effort. But there is no case for changing 'common usage', and we should be able to rely on the good sense of individuals to use the most appropriate term.
TMk5.3.2

*Thanks.*
Editor

**... Dropwire terminations – a fault stored for the future**
The reply to Mr Dodding's letter (MN14) on Dropwire Terminations on BT 41's prompted me to write. In this area, bad weather plays a big part in making it difficult for faultsmen to make successful terminations. Has any researcher tried pushing dropwire of any size into a BT with fingers numb with cold, and wind and snow howling round his ears – not to mention the dropwire insulation like cast iron? The faultsman's reaction is: strip it, get it into the BT, and

hope for the best ! A fault stored up for the future. We really must make a move in the direction Mr Dodding suggests.
R Hannah, M33, Bradford TA

*OPD/OP10.2.3 replies: The problems are appreciated and modifications are being made to the block inserts in BTs 41 and 41A which will reduce these difficulties. The grade of PVC used for the dropwire insulation does not make it noticeably more difficult to manipulate at low temperatures although it is more difficult to remove. So, with DW5 and 6 – which should not be stripped anyway – life would be made easier if faultsmen persevered in terminating them complete with insulation.*

*DW4 must be stripped though – but only with Strippers Wire No 2, correctly adjusted. Do not use 'cutters', otherwise the wire can be nicked, removing the copper coating which provides protection against corrosion. We can reassure you that THQ are pursuing a solution to all these problems so that they will be resolved once and for all.*

### . . . a Postscript from Brian Sapsford, Sv7.2.3

Seeing my article in MN14 prompted me to offer this postscript on the subject of metering checks. Some test call senders have the in-built facility to check the initial and first subsequent meter pulses. Others have been modified to provide this facility. Where call senders do not have a metering check it would be worthwhile implementing a suitable modification. Details are available from various sources, but a good one to try for the TRT 119 is obtainable from SETR/RHQ Service Division (0273 201237).

# How quality is assured

by **Mike Walkden,** PE, C3, QA3

**Assuring the quality of £500m of PO stores annually is the joint responsibility of many departments and divisions. The task of the Quality Assurance Division (QAD) of the PO Procurement Executive (PE) is to assist in achieving the required total quality at all stages.**

Briefly the function of the PE is to ensure that equipment, materials and services of the required quality are supplied in the right quantities at the right time and at an economic price to meet the demands of the day-to-day running, growth and development of the PO.

The PO buys a vast quantity and variety of engineering supplies ranging from simple items like telephone cords and earthenware ducts to extremely complicated ones like telephone exchanges, submarine cable systems and postal mechanisation equipment.

Many of these items are specially designed to meet PO requirements and are ordered against specifications which define the constructional features and performance characteristics considered essential to ensure satisfactory, reliable and economic operation in service. In other cases, proprietary equipment is purchased to the manufacturer's own detailed specification to satisfy an overall system performance specified by the PO.

The primary function of QAD is to ensure that engineering supplies and installations bought by the PO are designed to required standards and conform to specified requirements. To do this QAD formulates and operates quality assurance policies, procedures and practices to define and maintain the quality of items supplied to the PO. Their work includes :–

- QA of design – in co-operation with designers and developers.
- QA of conformance of product – in co-operation with manufacturer.
- QA of installation – in co-operation with installer.
- Acting as a catalyst for all three disciplines at all phases of a project.
- Reliability assurance.
- Maintenance of PO standards for measurement.
- Assisting with specialised electrical, mechanical and materials testing.

As a result of applying disciplined QA practices, the PO is aiding British Industry to achieve exportable telecommunications equipment of high quality.

But what does 'Quality' mean, and what is Quality Assurance ? One way of defining quality is to say it is the degree of excellence, or fitness for the intended purpose. As for 'QA', this is ALL activities and functions concerned with the attainment of quality.

### Historical note

Until the mid-1950s, goods were accepted by the PO on the basis of 100 per cent inspection by PO staff, or ad-hoc sampling inspection. This was followed by more formal batch-inspection methods, based on sound statistical principles. A range of 'Q' Specifications was written for each item, giving the quality requirements. But Contractors were not told of the POs requirements at the tender stage, neither did they have to declare to the PO their means of achieving the final quality of the goods. It was up to the PO to sort good product from bad.

In 1967 the PO imposed a requirement that contractors must have a properly documented and effective QA system operating from goods inwards to final product. Once QAD were satisfied that the QA system on a particular production line was working well, the contractor was permitted to use an 'Authorised Release' procedure, where direct PO batch inspection was not involved. In 1973, new Standard Conditions of Contract (DC800 and others) were issued in conjunction with a new series of quality (QM) specifications. These define a series of quality levels and limits, that can be stated at the tender stage. Another specification (QM1) lays down general requirements for QA of manufacture. This new system applies to both new and established items, and to PO or proprietary documentation. Following extensive discussions with suppliers and staff, QA requirements for *installation* were defined in 1975 in Specification QS1. The principles of installation QA are closely analogous to the approach in manufacture.

**The present**

As mentioned, the QM1 specification requires contractors to be fully responsible for quality of goods and services supplied, and the QM specs set out the particular quality requirements. The standards set are high, and relate to service needs. At the same time they are realistic, and recognise economic and manufacturing considerations.

Briefly, a contractor is required to :–

▲ demonstrate an effective QA system
△ ensure QA of all sub-contracted supplies and work
△ maintain quality records to demonstrate his system works
△ permit PO validation of any or all of his QA processes.

QADs role in all this involves a great deal of observation and examination of a contractor's QA system and related documentation. If this survey is satisfactory, the PO makes a formal validation by direct examination of the product. To assist with the more subjective features – soldering, for example – special Quality Standards Manuals exist which give guidance in words and pictures on acceptable standards.

Once QAD is satisfied with the validation, the contractor may be authorised to release items (or work) to the PO without direct PO inspection. However, the PO maintains a watchful eye on the contractor's system and products throughout the duration of the contract. Most PO purchases are now supplied under such Authorised Release conditions. This has not removed the right of the PO to inspect goods either 100 per cent or by sampling should the need arise – for example, in the event of consistent poor quality, or if a contractor's QA system is inadequate.

**QA of exchange installation**

Contracts for large electronic exchange systems now include Supplier Quality Assurance (SQA) for exchange installation, and this will probably be extended to all modern exchange systems. After QAD have agreed with the Supplier the procedures to be applied, a PO Clerk of Works oversees the contractor's operations on site. The PO responsibilities are described in TIs (*A6 F2501* for TXE4, for example) ; QS specifications define the contractual requirements.

**Reliability Assurance**

By participating in the development phase of new projects – for example, System X – QAD is able to contribute to quality assurance of design. One object of this is to avoid excess costs of modification at late stages in production or disruption once equipment is in service. Quality and reliability can be said to go hand-in-hand, having their origin at the design stage, and test methods must prove the design reliability at all stages in the product.

The cost of better design and reliability may well be reflected in higher initial cost. But our attitude is that this is acceptable provided they avoid even higher costs for maintenance during the whole life cycle. 'In-life' costs can be several times the initial cost, so that a whole life cycle cost design approach can be readily justified in many cases.

After the initial reliability prediction, QAD advocates testing programmes designed to discover weaknesses in components, assemblies and so on. The analysis of defects at all stages from design to installation, is generally more fruitful than trying to demonstrate that a particular mean time between failure (MTBF) has been achieved. MTBFs are useful in design, but for much telecomms equipment this will be of the order of years – implying an impossibly long test time. Hence, there is a need to include 'burn-in' tests for components plus extended stress testing of assemblies and systems, where practical, to provide this 'reliability screening'. The use of standard components is a major contribution to reliability, as is the continuous process of detecting design weaknesses from feedback and in-use testing.

**Future trends**

The trend towards miniaturised electronic equipment and away from the more traditional electromechanical items – which relied heavily on workmanship for quality – is leading to a need for greater emphasis on:

- assessment of all the QA procedures
- pre-contract QA assessment
- alignment with national standards (British Standards)
- automatic testing equipment procedures
- better component quality
- improvement in reliability
- improvement in design quality
- assessment of software (computer control) quality.

Many of these will be included in a new series of PO Quality Specifications (QES series) now being developed for electronic systems, which will be along the lines of the British Standard specifications.

The status of PO approval is already high worldwide, and the work of QAD continues to enhance this reputation.
PE/C/QA3 (01-739 3464 Ext 671)

# Plant requiring attention– A1024 reports

by **Bill Larman**, Sv5.1.1

A survey of jointing chambers in six telephone areas highlighted a number of problems including congestion, cleanliness, cabling, and cable supports. To some extent these could have been avoided by closer liaison between interested parties, so it was felt that some changes in reporting procedure might be necessary. In particular, it seemed that the A1024 procedure was not operating successfully. Detailed discussions with the POEU led to changes which have been incorporated in the TIs covering EPMC – External Plant Maintenance Centre – procedure (TI *E13 C0040*). Changes have also been included in the plant inspection procedures (*E3 E0111* maintenance, and *A2 C0231* works).

The TI covering the EPMC procedures has been completely revised and retitled: 'Advice of Plant Requiring Attention – Forms A1024 – EPMC Procedure' – a distinct change from its original title which tended to place a restriction on the items of plant to be reported.

The main change is to record all A1024 reports in the EPMC before they are distributed to the field group for action. This enables individual reports to be monitored and progressed. It also allows the overall situation to be assessed at any time to determine the total outstanding reports and, where necessary, to take action to clear-up any back-log. Another aspect is to give a priority rating to each report so that urgent work will be dealt with quickly. Some reports will be referred to planning groups using A6281 and A6282 forms, and these have been amended to follow the new EPMC procedures.

The changes to the plant inspection TIs are mainly to give greater emphasis on the safety aspects of the inspection, bringing them into line with the EPMC instruction. An important facet is the introduction of a new label 553A which must be attached to the plant being reported to assist other field staff in following-up the A1024 report.

Remember ! Improvements will never be achieved merely by changing the procedures. Only by operating the system will results be produced. So, all staff concerned with maintenance or provision of external plant need to play an active part – field staff in making out reports, and EPMC or Planning & Works staff in progressing the reports as quickly as possible. Inevitably, some reports will involve major work to achieve plant improvement, so it is important that feed-back of information to field staff is given, so that they know what is being done to rectify a particular problem.

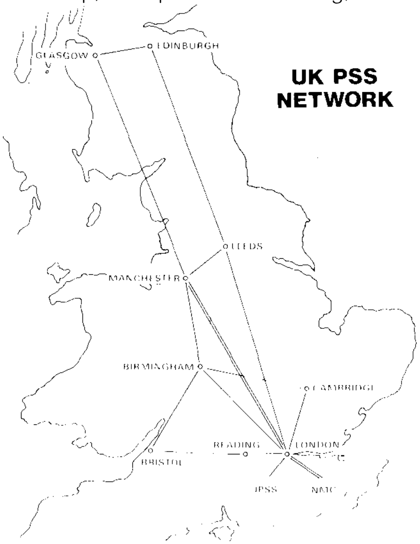
Finally, although the A1024 procedure will provide some information on external plant in need of attention, it is not the only answer to improving the state of plant. It needs to be operated alongside other sources of information, such as local line insulation routiner reports, A1057 returns, and from information obtained from customer-reported fault analyses.
Sv5.1.1 (01-432 1374)

# Packet switching goes public

**The 1975 Autumn issue (MN 8) introduced EPSS – the 'Experimental' Packet-Switched data Service. Early next year, when the permanent public packet-switched data service is due to be introduced, the 'E' will be dropped.**

PSS – as it is called – is based on the nine packet-switching exchanges (PSE) shown, which are interconnected by 48 kbit/s data circuits. PSS will be controlled from the London Network Management Centre (NMC) and, at the outset, maintenance will be co-ordinated from there.

To recap, with packet-switching, data is transmitted as a series of separate blocks or packets. Each packet is routed automatically through the network according to the control information at the start of the message. Additional digits at the end of each packet enable the transmission to be checked for errors. A single message may involve one or more packets. For inland connections, customers will be charged solely on their use of the service, irrespective of the distance involved. Because PSS has been based on international recommendations, UK users will be able to access international data links that use this form of switching. It will be connected to IPSS – the international PSS – whose first link, with the USA, was recently inaugurated – and to Euronet, the EECs database network soon to become operational.




## Main features

PSS will enable users to operate with either character or packet terminals. For character working, it will support a wide range of asynchronous terminals generating serial data at the commonly-accepted transmission rates up to 1200 bit/s. Such data will be converted to and from packets by a packet assembly/disassembly unit (PAD) at the local PSE.

Character terminals will link to PSS by means of a dedicated connection known as a Dataline, or use Datel 200 or 600 services over the public telephone network. There will be two Datalines for character terminals, operating at up to 300 or 1200 bit/s

Terminals using the public network will need to input a network user identifier (NUI) before PSS calls may be made.

Packet terminals – which assemble data into packets before transmission, and accept data in packet form – will link with the network only over a Dataline. Four types are available for packet terminals, operating synchronously at 2.4, 4.8, 9.6, and 48 kbit/s. Full duplex communication is available, with data being transmitted each way simultaneously.

A packet terminal may call any other packet terminal, or Dataline character terminal, and may use any type of call. On the other hand, character terminals are more restricted.

As mentioned, the London NMC will co-ordinate maintenance of PSS initially. For packet customers, all fault reporting will be to the NMC where, during working hours, staff will be able to accept and deal with all types of PSS fault. The exact procedures out of normal hours are still being worked out, but, in principle, the same procedure applies. Concentration of fault handling at one point overcomes the service problems often suffered by 'special service' customers. It also facilitates staff training. Customers with character terminals will report faults to the local Repair Service Control (RSC) using the 151 procedure, which will be dealt with in the normal way as for telephone service or modem. Where assistance is required, the NMC will be able to help users. In cases where customers are unhappy with their PSS service, they may seek help from the Data Customer Service Officer at the local Area Office.

*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 4089, Tenter House, Moorfields, London EC2Y 9TH. Say what you like, but the Editor may tone comments down if he decides to publish. Do please give your full address.

**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.**

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