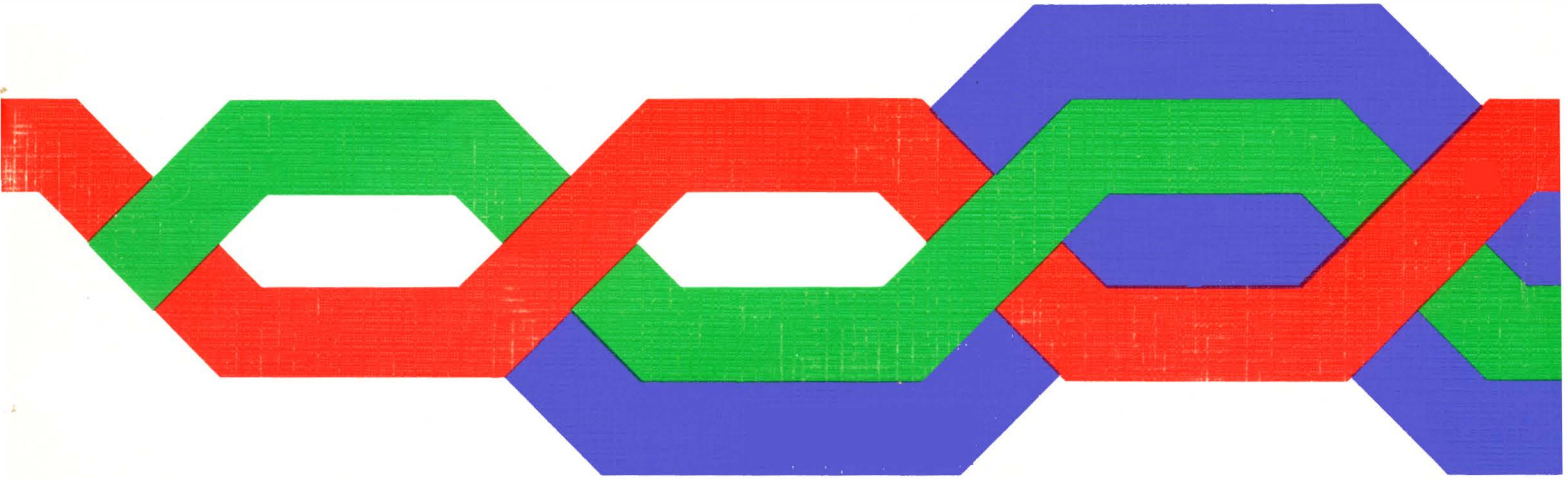
Maintenance News 7

Spring 1975



Contents.

Produced for SvD by THQ Internal Communication Unit

Maintenance News 7

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Letters.

The importance of maintenance

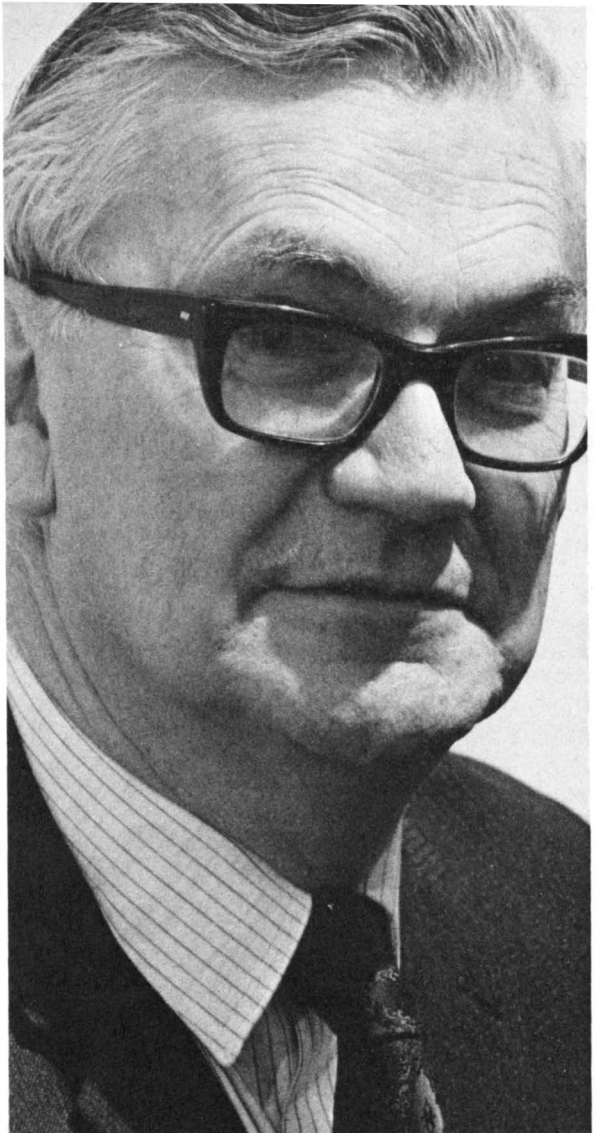
From the new Director, Service Department J E Golothan

Dear Colleagues

For the greater part of my time in the PO I have been closely associated with service matters and I need no convincing of the importance of maintenance in the scheme of things. It is a vital activity in helping to meet the needs of customers, in earning their goodwill and in running our telecommunications system - the third largest in the world - at peak efficiency.

With the increasing size of the system, the advance of new techniques and the steady introduction of modern and diverse forms of equipment, staff with maintenance responsibilities need to be well informed more than ever before. Our TIs, handbooks and other instructions are as comprehensive as we can make them but there is a need particularly among field staff to exchange information and to communicate on a less formal basis, and *Maintenance News* exists to meet that requirement. It has become a worthwhile news magazine but it will remain worthwhile only so long as readers in Regions and Areas take advantage of it to raise their problems, suggest solutions and question policies. In this way they can share field wisdom and experience with their Service Department colleagues in THQ. The first six issues of *Maintenance News* have provided a good start to this process. I look forward to it continuing and to *Maintenance News* making its own individual contribution to the success of maintenance effort.

Yours sincerely
J E Golothan



New and interesting challenges

From the Head of Sv5 Maintenance Division R H Adams

Dear Colleagues

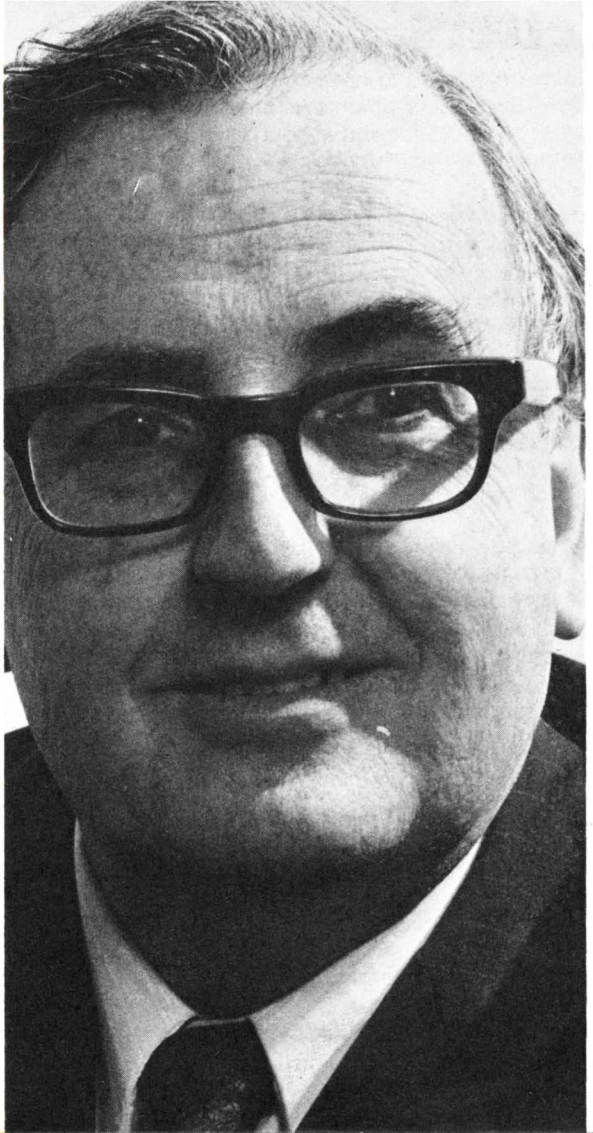
I have the doubtful distinction of being the new boy of the three maintenance Heads of Division, new both to Service Department and almost as new to service work generally. Even one's best friends point out that experience largely on planning and works in Region and Area is not the most propitious background for maintenance work at THQ. Nevertheless we do not live in watertight compartments and I have always been aware that we are all in the business of service to the customer and that engineering maintenance has a large and vital part to play in ensuring the satisfaction of the customer with his telecommunications services.

I am concerned with the Customer Apparatus and Ancillary Services Maintenance Division (Sv5). Its functions may be briefly described by listing those of the three Sections which make up the Division:

- local, junction and trunk line plant maintenance and the repair service;
- customer telephone and telegraph plant and call office maintenance;
- power maintenance, repair centres and network problems.

Our overall aim is to give the customer the service he wants at a price he chooses to afford. This means in general terms exploiting developments in materials and technology either to improve reliability or to reduce the time and cost of fault clearance or better still to do both - never forgetting of course that costs and quality of service will always be dominated by the large amount of existing plant in service.

If I can mention one particular class of plant, customer equipment: this has tended to be left behind in the rate of technical advance, as compared with for instance the transmission field. I believe however we are now seeing the beginning of an increased rate of technical change, keyphones and common control PABXs being straws in the wind, with wider ranges of equipment and greater facilities being offered to customers. Our job is to see that these



improvements are not obtained at the expense of high and continuing maintenance costs and indeed that wherever possible faults and costs are reduced. Such developments will provide new and interesting challenges to the field maintenance staff and without doubt, as always in the past, they will rise to the occasion.

Yours sincerely
R H Adams

Meter Performance Statistics

● What is the point of filling in the 'OK (working test)' box on form A3732 raised by accounts or traffic staff, when all it shows is that the customer is using his telephone less than before? And why do meter testers apply metering rates slower than the fast rates encountered in service?

L Veacock, Wimbledon ATE

An abnormally low meter reading can be due to the meter understepping, so it has to be tested. The test has to be done in working conditions because the meter may understep in the more stringent conditions imposed by a tester but be OK in service. On your second point, it is recognised that some meter testers apply pulses at somewhat slower rates than the fastest met in service. There are other anomalies too: meter testers are manufactured to designs which differ according to the type of exchange and metering system, and do not all apply the same tests. Development work now in hand should remedy matters.

L R Tanswell, Sv6.5.5 (01-432 9037)

● The meter fault rate should be expressed in terms of the number of meters tested instead of exchange connections, because fault rate is affected by sample size. Moreover, all meters in an Area should be tested at the same periodicity, since otherwise the fault rate statistic cannot be used for comparisons.

R Duers, Birmingham TA

Unless the sample taken is too small, the fault is independent of the number of meters tested. You find more faults if you test more meters but the fault rate stays the same. Meters should be routine tested at six-monthly or 18-monthly

intervals in accordance with TI E6 H0010; this will ensure adequate sample size and produce accurate figures. Of course, roughly the same number should be tested each quarter, or the fault rate, which is calculated each quarter, will fluctuate about the true fault rate (see para. 4.2 of the TI). Aggregated results for an Area can be expected to smooth out individual fluctuations.

L R Tanswell, Sv6.5.5 (01-432 9037)

● Has anyone considered whether the cost of the laborious and time-consuming job of routine testing subscribers' meters is justified? Why not confine testing to A3732 cases?

B Wigglesworth, Broomhill ATE, Sheffield

Because meters are read and bills are sent to customers quarterly, some metering faults are brought to engineers' attention more quickly by the A3732 procedure than by routine testing. Only cases of no metering and gross under or over-metering are detected this way. But it is not good enough to pick up only gross errors. By regular routine-testing all meters we aim to detect those producing small and intermittent errors and, because test conditions are more onerous than service conditions, we can find some needing readjustment before they actually misoperate in service. If we abandoned routine testing we might save in maintenance costs but there would be more complaints from customers, more loss and delay in revenue, and increased costs in clerical and traffic Divisions.

L R Tanswell, Sv6.5.5 (01-432 9037)

Safety in Exchanges

● The moment contractors enter an exchange building safety flies out through the door. In spite of protests by unit managers, every conceivable inch of space is crammed with racks and equipment awaiting erection, regardless of the welfare of staff. Nevertheless, in my experience, the only two serious accidents in exchanges have been to contractors' staff.

I think THQ should look into the question of payment on delivery.

R A Parrish, LTR/NC/ESC 13

Payment is already withheld for equipment delivered too far in advance. Arrangements are under review to improve matters. The difficulties of temporary storage are appreciated and a PO/contractors building sub-committee has been set up to consider them as part of a wider investigation into contractors' accommodation requirements. As for safety, contractors are bound by their conditions of contract to comply with any safety instructions given by the PO supervising officer, though the PO has to meet any additional costs incurred. In general, clerks of works, Regional Safety Officers and Area safety committees ensure that a high standard of safety is maintained.

Editor (01-432 1380)

Telegraph signalling conditions

● In the article on TDM and the telegraph network in *Maintenance News*, issue five I was saddened to see the brass-and-teak terms *mark* and *space* being used to describe modulation conditions. After many years on maintenance of international telegraph circuits and many disputes with distant terminals as to which of only two conditions they thought they were sending to or receiving from me, it became clear that a distinction must be drawn between the terms used for the code employed and those used for the transmission system. Examples of the terminology I would expect are:

Codes

Morse	- Mark/Space
5-unit teleprinter	- A/Z or Start polarity/Stop polarity
7-unit	- A/Z

Transmission system

Single current	- battery On (current)/battery Off (no current) or carrier On/carrier Off
Double current DC	- Positive battery/Negative battery
Frequency shift	- Upper frequency/Lower frequency

W J Cooper, DGM, LTR/NWTA

Not all countries adhere to the same conventions regarding 'mark' and 'space' signals. In this country, of course, the conventions apply uniformly and for end-to-end testing we can and still do use the terms. Controls on test-gear are typically marked 'SPACE(A)' and 'MARK(Z)'.

The conventions used by ourselves and other English language countries are recorded in the 'List of Definitions of Essential Terms' published by the ITU, Geneva. This says that the English term 'spacing' or 'space' in Morse, corresponds to the spaces separating marking signals and complete characters; in standardised start-stop telegraphy, it corresponds to the 'start' element; in start-stop automatic transmission, it corresponds to the absence of perforation in the tape; and in isochronous systems, it is assigned to the non-marking signalling condition.

B R Goodman, Sv6.4.2 (01-432 1316)

HRs on PBXs

● Remember 'HR Week' back in the late sixties when dry joints were detected and corrected? I believe it would pay to re-apply the idea to the main frames of all PBXs, with particular emphasis on private circuits.

P W Clifton, Reading Area TEO

N diagrams

● In his letter in *Maintenance News* issue four, Mr Houseman of East Grinstead said few faultsmen had anywhere near a full set of N diagrams. I requisition and distribute N diagrams in this Area and if an engineer wants one he simply asks his supervisor. As for the folders being 'terrible', I don't agree. I admit the index can be a bit laborious but as for some diagrams being 'very poor' can Mr Houseman explain what he means?

R Smith, LTR/CY/ESC 34

Notes.

Delay action fuse for motor uniselectors

● With reference to the article in *Maintenance News* issue six, will readers please note that the delay action fuse has been coded fuse 75A and stocks should be available to meet the national demand in the near future. The item should be used *only* for motor uniselector group selectors to AT 4917, since it is only in this circuit that rupturing of the fuse will bring up the release alarm. Further work is being done on deisgns of N-link fuse for other motor uniselector circuits and other mechanisms.

R W Felgate, Sv6.5.6 (01-432 1342)

Will readers also please note that, through my oversight, credit for the article was attributed solely to Mr Pearce of ETR/S1.1.1. In fact, he had a co-author, Mr R J Dyson of ETR/S1.1.1.1 (0206 89308), who was responsible for most of the development work on the fuse.

Editor (01-432 1380)

Private switched networks

● By way of follow-up to the article in issue five, we would bring to readers' notice the TIs in the *E1 C4200* series on maintaining particular large private switched networks. These will shortly be issued giving information on special maintenance organisation and procedures, maintenance aids and test-gear, spares, and telephone numbers to ring for help with the more difficult service problems.

We in THQ/Sv7.1 (formerly Sv5.2) and Sv5.3 will continue to look after TIs for the large national networks, but look to Regions and Boards to cover networks under their control. Since nearly all private networks will cross Regional and Board boundaries, drafting agreed instructions will call for close co-operation. *TI E1 C9001/NWTB about a police network wholly within NWTB control shows what is wanted.*

GE Richardson, Sv7.1.1 (01-432 9148)
K R Seamans, Sv5.3.2 (01-432 1382)

Blast wrecks exchange.

At 9.32 pm on 29 October 1974 there was an explosion in Bishopwearmouth exchange. The building - housing a 5000 multiple ND satellite of Sunderland - was completely wrecked and all services were cut off. A fire started in the cable chamber and burned for some time, causing extensive damage to the MDF and terminating cables. The Gas Board found a fractured four inch gas pipe and a full investigation is being made to establish the cause of the explosion and the circumstances leading up to it.

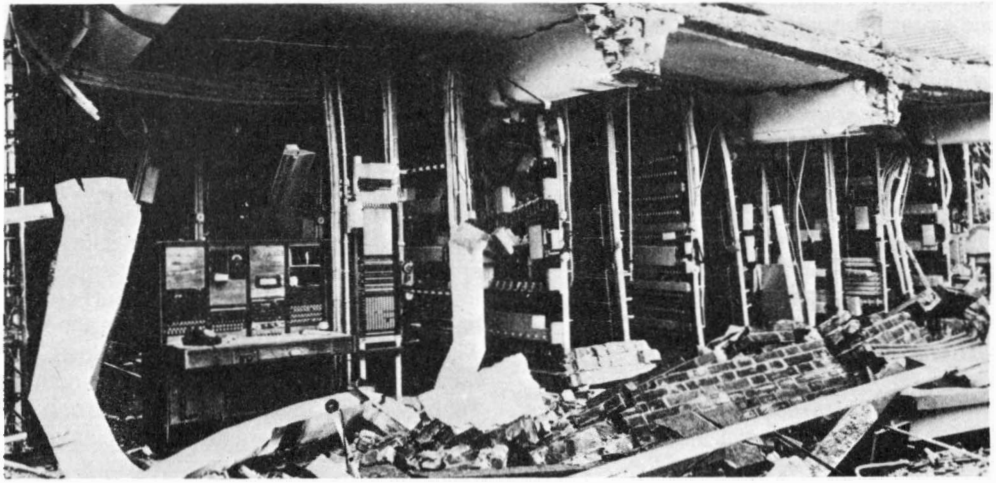
In the initial stage of restoration, important lines were diverted to Sunderland and extra public call offices were provided, using pairs in junction cables to Sunderland. At the same time arrangements were made to divert the rest of the lines to an adjacent satellite, East Herrington. A recent extension at this exchange gave some spare capacity and the site was large enough to accommodate five mobile ND exchanges and a mobile tandem. There were needed to give full restoration, there being no suitable place at Bishopwearmouth to site these mobile exchanges.

Work to provide a 1000 pair cable for a boundary change involving Bishopwearmouth and East Herrington exchanges was pushed forward. In addition, a 1200 pair cable and a 2000 pair cable were provided between the two exchanges, 2000 metres apart. To complete this work 300 metres of duct was quickly laid by contract and a new JRF10 was built to simplify the change-over arrangements. The jointing machine was used with these large cables and rapid progress was made.

The destruction of the side walls caused the roof to drop to the point where it was supported by the racks. This meant that there was a lot of equipment which could be saved if only it could be got out, but there was also a real danger that the weight of the roof would cause the whole thing to collapse. The demolition contractor was able to secure parts of the building to make it safe enough for equipment to be removed, in this way much of the equipment was recovered.

As usual, in an emergency, a great deal of effort was put in by the people involved. Their efforts were rewarded on 11 December when service was restored to all customers. But this was only a temporary conclusion as the job of permanent restoration must now go ahead.

NETR



Those gas leaks!

- **Gas leaks into underground plant**
- **Duct seals in operational buildings**
- **Inspecting duct seals**
- **Action if gas penetrates a building**

Many hundreds of reports of gas leaks into our underground plant are dealt with each month by External Plant Maintenance Controls (EPMCs). The British Gas Corporation (BGC) headquarters tell us that leakages are likely to continue to be a problem for the next three to five years. After that, the money and effort now being expended on maintenance and repair will improve the situation. It must be acknowledged that the BGC have, at all levels, been most helpful in dealing with the problem.

As explained in the article on gas in *Maintenance News* issue four, the main reasons for the large number of gas leaks are: the conversion from manufactured gas to dry natural gas; the use of higher pressures, damage to gas mains (yes, underground gas plant suffers from the attentions of the excavating fraternity too!); and the deterioration of gas mains through drying out, which normally takes place within three years after conversion. Remedial measures include completely renewing the mains, the introduction of joint swelling liquid, sleeving with plastic piping and, where the diameter permits, engineers actually repairing defective joints from within the pipe.

It is PO practice to lay most cables in ducts. These, in many situations, run parallel to or very close to gas mains. Since our ducts are by no means gas-tight they often become permeated with gas when there is a leak. Provided the ducts are not isolated by being waterlogged the gas can migrate in the tracks for long distances and since ducts eventually end up in buildings, there is a risk of that stray gas getting inside.

What are our defences? In the larger and older cable chambers where there are many lead-sheathed cables, the duct entries are sealed with a framed lead sheet bolted to the wall. All cables passing through the seal are plumbed to it. A drain cock is fitted to the top of the seal for gas testing and to the bottom for draining water. There is a common space between the ends of all the ducts and the lead sheet. In the larger modern cable chambers framed PVC sheet seals are used. But here, each duct is individually sealed to the sheet with a caulking gland. The seal round the cables is achieved by compressing compound 16* between two discs with a threaded cap. In smaller buildings external ducts terminate at the end of cable trenches and sealing is normally effected by compound and cotton waste.

These are the ways in which gas is kept out of our buildings and it is vital for all of us to ensure that these seals are fully effective.

In particular YOU MUST always test for gas when opening a duct seal and never leave a duct way unsealed when not actually working on it. This applies, for instance, even when just away for a lunch break. (*TI E3 H1110* gives full information.)

In April 1974, THQ/SvD sent out a circular calling for engineering officers-in-charge of buildings (EOCs) to make sure that duct seals were regularly inspected. This requirement has now been incorporated in *TI E1 A1505,* shortly to be issued. If you have any doubt as to the effectiveness of a seal, advise your EPMC straight away and ask for immediate attention. If you do not know their normal telephone number call the operator and ask for Freefone One Double One. Make a similar visual check of all duct seals immediately following work in cable chambers and trenches; and where temporary seals are fitted inspect them daily. And don't forget the entry points into the building for services such as water and electricity. Make sure they are well sealed too. In fact look for every potential source of gas, including building defects, and report them promptly.

**Compound 16 is a greyish fibrous mastic.*

Do not forget to make gas tests as laid down in *TI E3 H1110* before entering a cable chamber or trench to make visual inspections. If your building does not have a gas indicator no 5, take the matter up with your supervising officer. In the meantime ask for help from your EPMC. If you do get a positive indication of gas carry out the instructions laid down in *TI E1 A1505*.

The main points to remember are:

- *Close the cable chamber door or replace the trench covers.*
- *Ventilate the building.*
- *Inform the EPMC, the senior officer present and your own supervising officer.*
- *And if there is a reading of 50 per cent or more of the Lower Explosive Limit (LEL), the building should be evacuated.*

The other defence against the build-up of an explosive atmosphere in our buildings is ventilation. Natural gas becomes potentially explosive when its concentration in a gas/air mixture reaches five per cent. So if gas penetrates a building it is important to prevent this degree of concentration being reached. Besides ventilating the building, ask the EPMC to ventilate the external underground plant in the immediate vicinity of the affected building by removing the jointing chamber covers. And where practicable, extinguish all possible sources of ignition such as pilot lights.

A new form of ventilation is being looked at. It has been demonstrated experimentally that a vent pipe fitted to a manhole has an appreciable scavenging effect: a trial installation in an exchange manhole is now being made to see what effect it has under working conditions.

Possibly the first warning of gas leaking into a building is the detection of the characteristic gas smell. All distributed gases are odorised at source and cases of de-odorisation are rare. So your nose is valuable in detecting gas. But don't only rely on your nose; individual sensitivities vary and constant exposure to a smell can result in a decrease in awareness.

EOCs of operational buildings will, in future, be given warning of the occurrence and subsequent clearance of gas leaks into PO underground plant in their vicinity. On receiving such a warning, an immediate visual re-check of the duct seals should be made after first carrying out the prescribed tests with the gas indicator no. 5 in the cable chamber or trench.

Some exchange manhole covers have holes through which the sampling hose of a gas indicator no. 5 can be introduced. Here, a further check could be made for gas immediately outside the building. A dipstick should be used first to prevent water damaging the instrument. If these tests show gas carry out the reporting and remedial actions already described.

Manufactured town gas and natural gas are both lighter than air and their dispersal is made easier by this fact. There are, however, well over a score of places in this country where the BGC distribute liquid petroleum gas (LPG)/air mixtures because of their remoteness from the national distribution network. Your EPMC has details of these. These LPG/air mixtures (the LPG may be either butane or propane) are heavier than air. So be careful to test and ventilate at low levels. If the kettle boils over on the retiring room stove and puts the gas out, the unburnt gas may well collect in deadly layers at floor level. The same special precautions should be taken with propane gas the PO uses for plumbing. Indeed, wherever 'bottled' gas is used, its properties should be borne in mind, particularly if you use it in boats and caravans at weekends.

The danger of gas explosions in our operational buildings is very real, but it can be reduced if the defences are kept in good order. Internal maintenance staff can play a vital part in ensuring safety, by keeping an ever-watchful eye on duct seals: have you looked at yours lately?

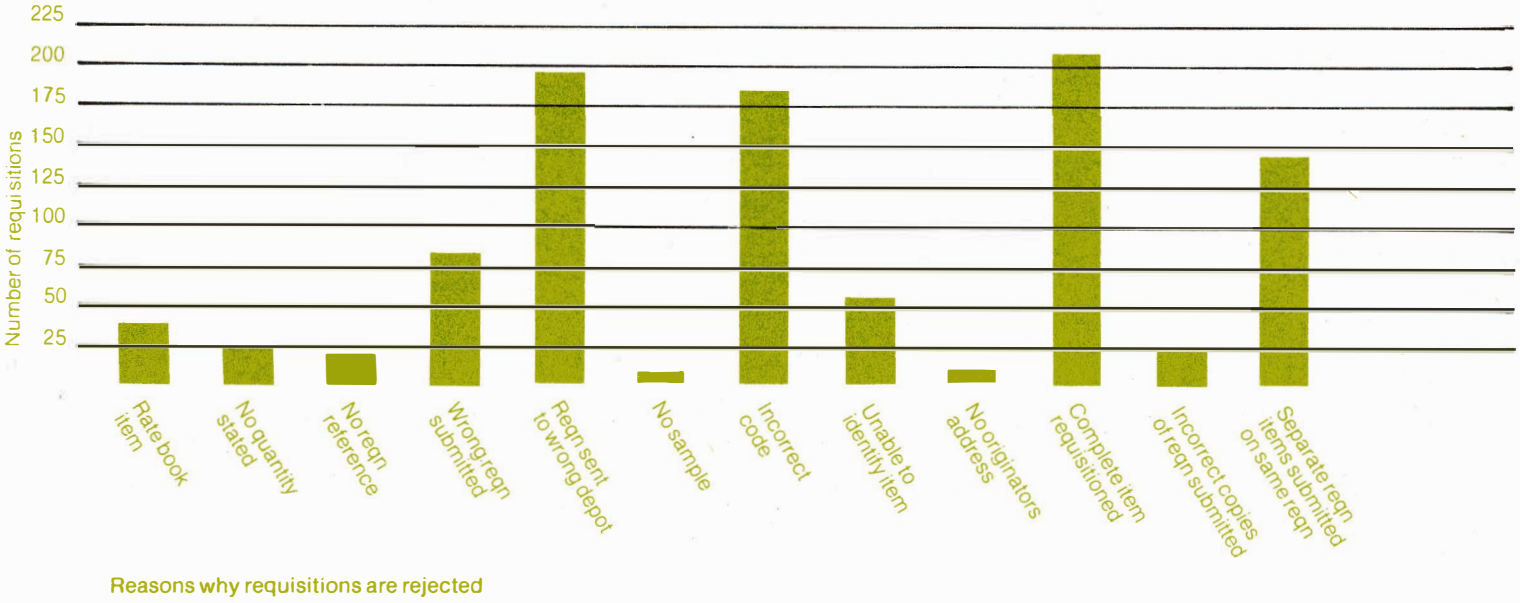
D W Finch, Sv5.1.2 (01-432 1306)

Why we reject 12 000 requisitions every year.

The Factories Division Piece-Part Depot at Fordrough Lane in Birmingham is well known to engineering staff who maintain automatic exchanges and transmission equipment. The depot holds a stock of about 25 000 items, valued at over £1M, and provides a 48 hour maintenance exchange service.

Every month, 10 000 requisitions for replacements are sent to the depot, of which 90 per cent will be dispatched within 24 hours. Most of you probably realise what a good service you get. But the fact is that every month about 1 000 requisitions are rejected because they have been submitted incorrectly, and consequently have to be returned to the originators - except those where no address has been given. This means sending another requisition, which results in delays, so adversely affecting maintenance performance. This is apart from the unnecessary frustration and waste of effort by depot staff.

Requisitions rejected by Factory Division Piece Part Depot during a 20 working day period



Reasons why requisitions are rejected

It should be realised that very many more requisitions would be returned to the originators if it were not for the patience and expertise of the clerical staff. Some people, it must be said, are getting a better service from the depot than their requisitions deserve.

The bar chart is divided into 12 categories and shows why 976 requisitions were rejected during a recent 20 working day period. It will be seen that the following four categories account for 73 per cent of rejections: requisition sent to wrong depot; incorrect item code; requisition submitted for complete item instead of the required parts; items proper to separate requisitions submitted on the same requisition. For the last category, *TI G3 B2515* seems ambiguous and we will be clarifying it. As most rejected requisitions are those that are submitted for Strowger piece-parts, it may be helpful to mention that the applicable parts TIs are listed in tables 1 and 2 of *TI E6 H5501* and also in indexes such as *TI E6 A0001*.

THQ is concerned about the high rejection rate of requisitions and the consequent adverse affect it has on service to our customers. To improve the situation, staff originating requisitions for items stocked by the Piece-Part Depot should ensure that they know the requisitioning procedure. It is hoped that this call for adherence to the guidance given in TIs will result in a great improvement, but any constructive comments or suggestions you may have would be welcome.

D F Fabian, Sv5.4.3 (01-432 1330)

Running TIs.

Many readers will be well aware of special maintenance information TIs, colloquially called 'running TIs'. These contain information which, THQ consider, deserves the special attention of maintenance staff. They usually cover difficulties being experienced under working conditions, and give advance information on solutions to them. In many cases difficulties have been brought to light by A646 reports from the field - see the article in issue two of *Maintenance News* and *TI E1 A0091*.

Running TIs are re-issued at intervals when new items need to be brought to attention and old items can be withdrawn as having served their purpose. Sometimes the information in these old items is transferred to more permanent TIs which deal with the equipment or practice concerned; but sometimes there is no need for this and the information just disappears.

Some Regions think the running TIs so valuable that they have said they are the only TIs that most external maintenance and SA and L maintenance men need to carry about with them. Unfortunately, agreement cannot be reached on this - which is a pity, because the fewer TIs a man has, the more likely he is to read them. However, the problem applies to other maintenance staff as well, such as those in exchanges and repeater stations. The running TIs tend to get lost in the mass of other TIs and so often go un-read.

It seems that many supervising officers are not bringing the running TIs to the attention of their staff as they should. We get many calls about problems previously explained in running TIs, and we find from our travels that there is widespread ignorance about them. Perhaps supervisors rely on the fact that their staff get copies for their own files. Perhaps they don't look at any TIs before the CA files them.

For the benefit of those unfamiliar with them, here is a list of all the running TIs at present issued and a few that can be expected fairly soon.

E2 A0101	Overhead
E3 A0101	Underground
E5 A0101	Subs app general, inc PMBXs
C0101	Call offices
D0101	PABXs

E6 B0101	TXE2 and MXEs (mobile electronic exchanges)
C0101	TXK1 - *not yet published*
C0111	TXK3 - *not yet published*
D0104	All Strowger exchanges
D0105	Strowger D, ND, SAX and MNDX only
D0106	Strowger Director exchanges only
D0107	Strowger ND, SAX and MNDX only
D0108	UAX 12, UAX 13, UAX 14, MAX 12, MAX 13 only
D0109	Routiners
F0101	SSMF 2
F0102	Line relay-sets and signalling units
G0101	Ringing and pulsing machines
G0102	Voice frequency machines and equipment
G0103	Information Services equipment
H0112	Relays
H0113	Mechanisms, wipers and banks
E7A0101	Telegraphs
E9A0101	Line transmission equipment general - *not yet published*
A0102	Line systems power supplies
A0103	Audio equipment
A0104	FDM terminal translating equipment
A0105	FDM carrier generating equipment - *not yet published*
E12A0101	Telecommunications power plants
E13B0101	RSCs

The running TI system has certain inherent disadvantages: they have no immediate eye-appeal, looking just like other TIs, then, you can only get extra copies if you agree to have the same number of extra copies of all other TIs that come to your file. Of course, you can specially requisition them each time, or resort to photocopying them but this is time consuming and expensive. Some people in the field say that the information in running TIs is withdrawn too soon - it would be better if the recipient could keep it until he knows he has finished with it. Finally, every time an author wants to say something new in his running TI he feels duty bound to consider whether old items can be withdrawn. As time is needed for research, he saves up items until he feels the complete re-issuing exercise is justified. This means that his new information is not as fresh as it might be.

For these and other reasons we are considering replacing the running TI system by a system of single sheet maintenance bulletins, or possibly making more use of Regional Newsflashes to disseminate THQ information.

D J Manning, Sv5.4.1 (01-432 1380)

NCC News.

Coaxial Cable Failures - Telephony Links

In issue five we referred to the reduction of coaxial cable failures attributable to human activity as being one of the major factors contributing to the improved performance of coaxial cable regulated line sections (RLSs). Although major service failures resulting from cable faults are only 25 to 30 per cent of the failures on the coaxial cable network, it is worth paying close attention to them because they take up about 60 per cent of the outage time and they are costly to repair.

Some questions come to mind. For instance do we find plant more reliable as the number of small-tube cables has increased and as brazed joints have gradually replaced originally soldered joints in the older cables? We might also ask whether there is any change in the incidence of failures due to human activity - especially as publicity has been directed both to our own staff and to outsiders with the object of reducing cases of cable damage.

NCCs have been studying the incidence of major service failures since 1968 and the graphs show some trends in the percentage of coaxial cable failures since then. Figure 1 shows the total annual RLS failures owing to cable faults and how the total is apportioned between human activity and plant failures (for example, pulled joints and creepage). The downward trend results mainly from the reduction in faults due to human activity. Figure 2 shows how these are split between PO activity (including PO contractors) and non-PO activity. We see a laudable steady reduction in self-inflicted wounds but failures due to the activities of others still present a problem.

The number of plant failures (fig 1) shows no definite trend, because there has been a very large increase in the length of plant in service. But the RLS failure rate in faults each 100 km each year (fig 3) has actually fallen from about 0.3 to 0.05.

T S Farres, Sv7.1.3 (01-357 2643)

Figure 1 RLS failures due to cable faults

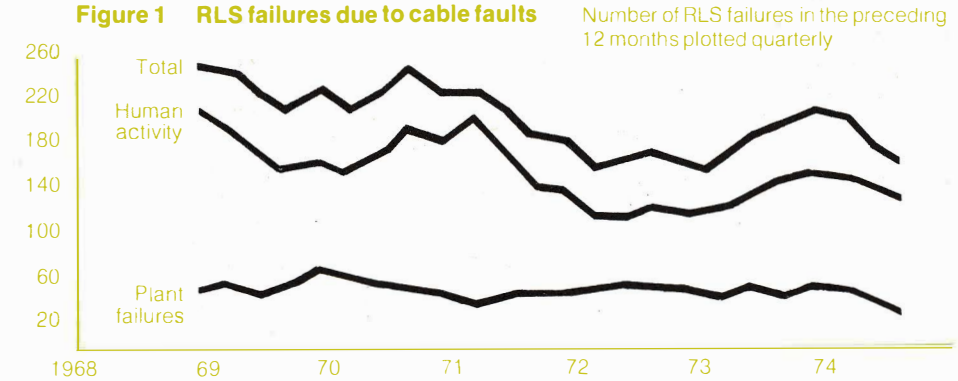


Figure 2 RLS failures due to human activity affecting cables

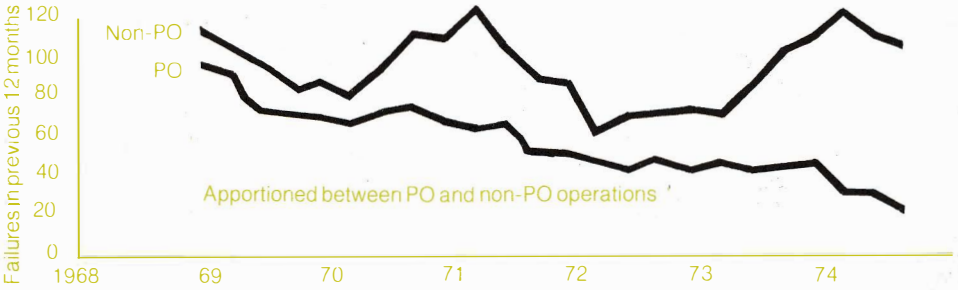
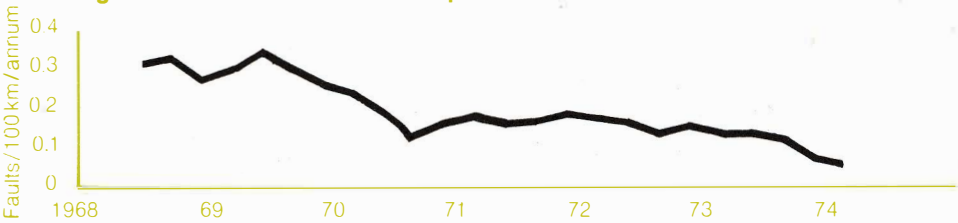


Figure 3 RLS failure rate due to plant faults on coaxial cables



Data transmission—PO datel services.

In issue six I briefly introduced the principles of data transmission and explained the need for high speed data binary signals to be transmitted as voice frequency signals over speech-quality circuits. Any reader can hear recorded sequences of these signals by dialling 01-278 6061 and waiting for ringing tone to finish. This article outlines some of the ways various PO datel services provide data transmission facilities for customers; later articles will deal with some of the PO equipment items and circuits used.

Computer bureaux

Here, a private firm, called a computer bureau, provides one or more large and expensive computers. Bureau customers reach it by dialling over the public switched telephone network (PSTN). A typical and much simplified example of this is shown in the upper part of figure 1.

A bureau customer pays the PO for use of the PSTN and rents exchange lines, telephone apparatus and datel modem(s). A modem is a combined modulator and demodulator for converting binary data signals into voice-frequency signals suitable for transmission over the PSTN and reforming received vf signals into dc signals. After setting up a telephone call to the bureau, the customer switches his line to the PO modem, putting his data terminal equipment (DTE) on-line for data transmission. DTEs can comprise a variety of equipment, in some cases unique to the bureau's data system - for instance keyboards, visual display units and teletypes for producing characters printed on paper known as 'hard copy'. DTEs are not usually provided by the PO but have to be authorised as 'permitted attachments' for connecting to the PO system.

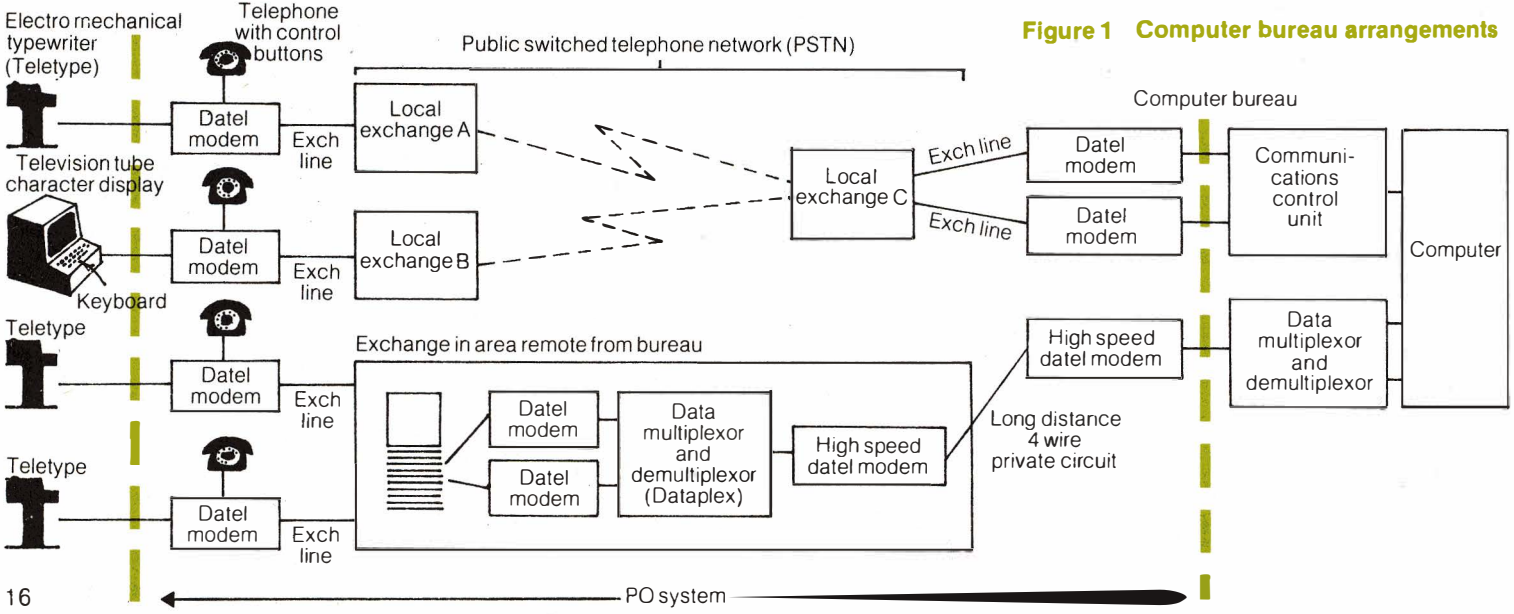


Figure 1 Computer bureau arrangements

The bureau operator ensures that every caller using the computer is an authorised customer; that the right computer language and program are used, and that the correct charge is made for the service provided; the bureau also ensures that customers' data information is secure from other users. A considerable vocabulary describes these processes, including interesting words like 'protocol', 'handshaking', 'passwords' and 'contention'.

The operator can also arrange to transfer work from the central computer to another one by using a high-speed data private circuit. This other computer may handle a particular program or may be 'more powerful', as the computer people say, meaning that it can handle data at faster speed or is of greater capability and capacity.

Bureau customers use the computer for many reasons, such as preparing employees' pay statements, or solving business calculations or technical problems. The computer is programmed to provide the desired output when the customer transmits appropriate input data over the line.

Dataplex

The lower part of figure 1 shows in much simplified form an arrangement where, after dialling suitable codes on a local exchange, a group of customers remote from a bureau can gain access to it over a single high capacity private circuit. Instead of being given access to the bureau by bulk Tariff J or H circuits, the customers' lines are 'concentrated' or 'multiplexed' onto the common four-wire data transmission bearer-circuit; transmission takes place simultaneously between the customers' terminals and the computer. The PO service providing these facilities is called Dataplex: fuller details will be given in a later article.

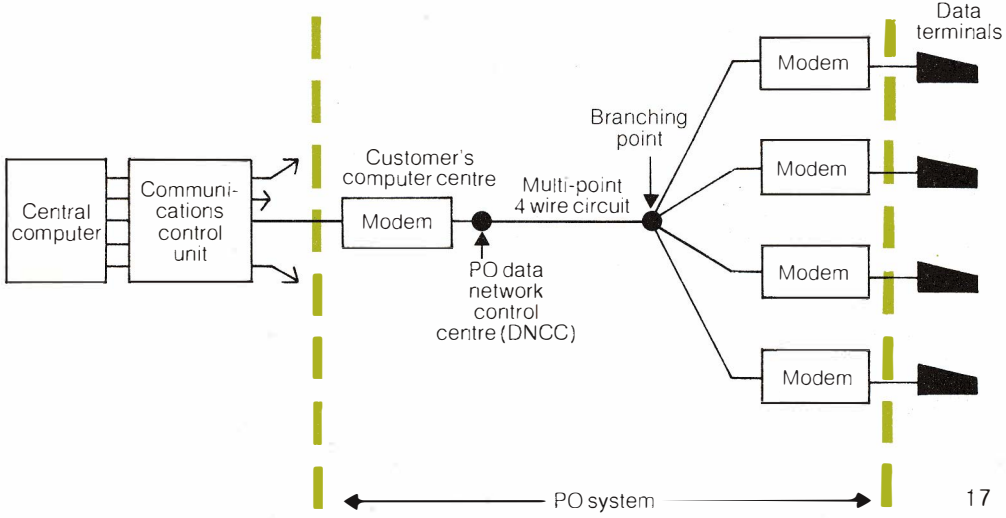
On-line applications

In all these applications the computer is regarded as 'off-line', since it is only 'on-line' to a customer when it is exchanging data over the PSTN. In 'on-line' applications the central computer is permanently connected to distant terminals by a network of PO private circuits, and since the computer and the terminals belong to the same firm the arrangements are sometimes called an 'in-house' system.

Typical users are the major banks and manufacturers. Banks have networks linking their branches to a central computer, which processes cheque transactions, as well as other accounting operations, from central records. In this way the work is done centrally instead of locally. Manufacturing organisations also use central computers for management, production and technical operations.

In such networks, which can be very large, many of the private circuits are 'multipoint' circuits; these branch out some distance away from the centre to serve a group of remote terminals (see figure 2). Multipoints cut down the number of circuits required, and may be

Figure 2 Simplified arrangement of one element of a data multipoint network



A typical computer bureau

necessary because limited inputs (the jargon is 'ports') to the central computer.

In networks for the major banks the computer is usually programmed to continually send out sequence-coded signals unique to each terminal. When a terminal recognises its own 'call sign' it responds if it has any data to transmit or receive. The process is known as 'polling' the terminals. During the night the data system operators may switch off the system and then 'run-up' procedures have to be followed early next day before business starts. PO staff can be left with red faces if a terminal fails to respond because of an overnight fault on a PO curcuit, perhaps caused by work on an MDF or cabinet.

Customers who commit themselves to these on-line data systems become heavily dependent on them and cannot easily resort to other means of conducting their business. Their data processing managers and subordinate staff can have a difficult time when any of their terminals are 'down' through PO circuit or modem faults. Moreover, down time costs the PO money in lost revenue. For both these reasons we should give prompt and effective maintenance attention to restoring service to our datel customers when any of our facilities fail. This does not just affect specialist datel maintenance officers looking after PO modems and other equipment at the terminals. All maintenance staff have a part to play, since faults can occur anywhere in these large and complex networks.

B N S Allen, Sv7.1.2 (01-432 9155)

Repair Service Controls (RSCs) have been, and continue to be, a topic of discussion in Areas, Regions and THQ. Field trials and studies of Repair Service work are continuing, together with field trials of new-style RSCs. Standard test desk design and RSC accommodation standards are being studied and agreements on which RSC staffing is based are under review.

These studies all fit into an overall RSC objective: this article explains how they interact and describes the work being carried out to meet the requirements of future RSCs.

The problem

The basic equipment and accommodation at most RSCs was originally provided to meet the needs of many engineering duties, only some of which are part of the Repair Service. Despite an overall reduction in the fault liability of telephone plant in recent years, because of the increase in system size, the processing and clearing of fault reports has developed into a major task. The Repair Service is therefore increasingly looked upon as an organisation requiring its own hierarchy, performance standards, procedures, purpose-built equipment and premises. This means that an RSC must be considered separately, not as an adjunct to a

The future of RSCs.

by W L Bowdidge

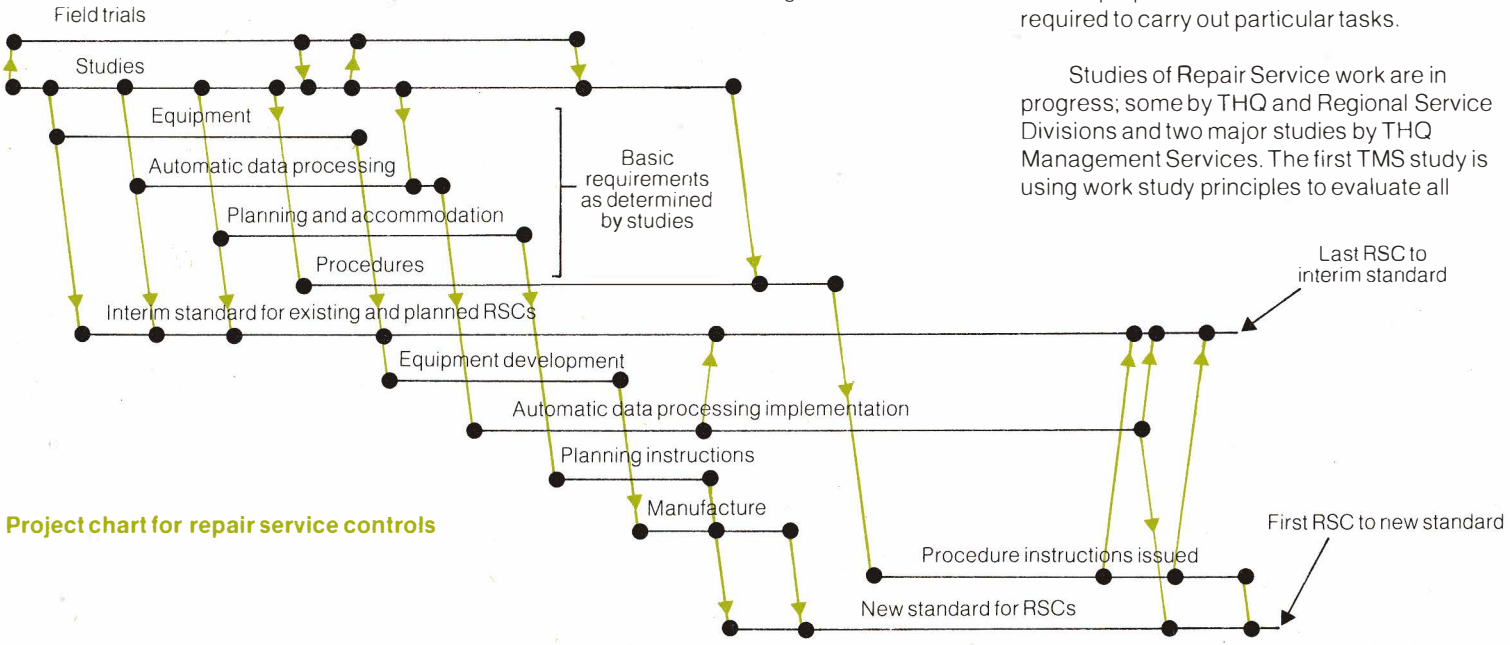
new exchange or exchange extension. This is the heart of the problem. There are as yet no procedures to specify a purpose-built RSC; and a full re-appraisal of RSC furniture, equipment and accommodation must be carried out before such a specification can be written.

Steps to a solution

A general solution needs to be applied to some 350 RSCs in the UK, each having an individuality determined by its size, location, plant maintained, and the people it serves. The solution must comply with national standards and also accommodate local needs. Each part must therefore be tested against various conditions and then fitted into the overall pattern. The design of future RSCs can then be built up from this framework.

The stages are illustrated in the chart which shows, in simplified form, the main areas of work. The progress of these is indicated by the horizontal lines. The interconnecting lines show information transfers between inter-related tasks; again, for simplicity, these have been kept to a minimum. In many cases the interchange of information will be almost continuous. The lengths of the task lines have been tailored to produce a readable chart; they are not proportional to the estimated time required to carry out particular tasks.

Studies of Repair Service work are in progress; some by THQ and Regional Service Divisions and two major studies by THQ Management Services. The first TMS study is using work study principles to evaluate all



Project chart for repair service controls

aspects of direct reporting RSC work; reports on some procedures have been issued and implemented. And further reports will follow as the study progresses. The findings of this study will affect all the projects covered in the chart. The second TMS study is dealing with the problems of automatic data processing in the Repair Service; these are outlined in the next section. Part of the studies require field trials which feed back information and may lead to further changes. The studies and trials form the base from which requirements and practical solutions for each of the task areas are being obtained. Staff associations are keenly interested in these developments and are being kept informed by regular reports to the Experimental Changes of Practice Committee (ECOPC 3). Local staff and their representatives are involved in meetings ranging from informal discussions to more formal committee meetings.

Automatic data processing

RSCs need to record information while progressing fault reports from receipt, through diagnosis to fault clearance. Much of this is formally collected and analysed to provide plant performance and customer service information. Most of this work is carried out manually and has to be limited because this work must not interfere with the RSC's main function. The prime objective of automatic data processing (ADP) is to reduce manual recording and analysis to a minimum without degrading essential information. From this, we can consider more detailed analyses of plant performance and customer service to help improve the standard of maintenance. Field trials on the practicability of such a system at RSCs have been carried out. Studies continue to see whether a full ADP system can be applied to all RSCs. If it can, further field trials will determine the design of a complete system and this will be followed by gradual implementation, probably Area by Area.

New equipment

All design aspects of purpose-built RSC equipment are under review. The first objective is to determine what equipment facilities are required at a direct reporting RSC. New demands must be taken into account, including those of new switching systems, new customer facilities and new maintenance aids. The suitability of present testing facilities and the communication systems required by RSCs also have to be established. The second objective is to specify how all these facilities are to be tailored to meet the ergonomic and environmental requirements of an up-to-date control. All these items will be specified as service requirements and will form the basis of a development project for the design of new RSC equipment. The project will be put to THQ/TDD, who will program the work and produce circuit and layout specifications, from which new RSC equipment can be built to the best possible engineering and design standards. A manufacturing contract can then be placed, using the development documents, for producing new standard RSC equipment.

Planning and accommodation standards

The new standard equipment will need to be installed in specially-designed accommodation. To do this, the size of future RSCs must be forecast and plans for the required accommodation must be made early in the building programme. Information on building layout and accommodation standards for RSCs needs to be provided as instructions. Some of these standards will appear in new TIs, and others in existing TIs not specifically covering RSC requirements. The objective is to introduce a basic plan procedure to determine future RSC requirements and a master plan procedure to ensure that the right accommodation is available. Further work will consider furnishings and ancillary equipment, for example, the record storage requirements of RSCs where automatic data processing of information is to be introduced.

New procedures and instructions

Any change in standards or equipment is likely to involve changes in procedures and, therefore, a change in instructions. A major review of repair service instructions is envisaged as a result of these fundamental changes. This must progress at a pace dictated by all other studies, but there must be instructions ready for each new phase implemented.

Jam today?

Looking to the future is right and proper. Solutions must be sought, which take full account of all aspects of a problem, and how these relate to other problems. But these take time. And what happens meanwhile? We need to take advantage of solutions and new facilities as they become available, and this we intend to do. Reports from current studies have

already been issued on new TOS record procedures and revised testing procedures. These can be implemented at any existing RSC. A sub-committee of ECOPC 3 is studying selected direct reporting RSCs to identify changes, to be implemented in the short term, which will contribute to an improved customer service. Among changes considered will be interim recommendations from the long term studies and trials. The information gained from this short term study will be available to all RSCs.

For proposed RSCs, module style equipment with testing, test access and communication facilities, is being made available as an alternative to standard test desks. This equipment incorporates several new features based on information from studies and is designed for use on a standard office table. A fuller description of these facilities and the arrangements for modular equipment will be the subject of an article in a future issue of *Maintenance News*. As further facilities and recommendations become available they will be incorporated into new modular equipment. So the results of the long term work will be used as soon as available. This will ensure that new RSCs which precede a full standard solution will be as up-to-date as possible.

W L Bowdidge, Sv.5.1.3 (01-432 1379)

How much does a fault report cost?

by B J Turner

The size of the telephone system, measured in telephone stations at April 1974, was 19 million, with 6600 exchanges and 12 million exchange connections; growth was nine per cent a year. To maintain an acceptable service in 1973/4 we employed over 40 000 maintenance staff at a labour cost of £113M. For our own business efficiency, and for the sake of our customers, we all try to improve service and keep costs down; but the fact remains that the cost of faults in the system has to be borne by our customers. This article examines how we arrive at the average cost of dealing with a fault report on customer telephone apparatus; and how keeping a watchful eye on this particular cost helps fix an economic tariff.

To determine the average cost of dealing with a fault report we need to know direct and indirect costs.

Direct costs include the cost of time spent by faultsmen, testing and records time spent by control staff, and the cost of stores. Time spent is allocated to the appropriate subheads, SU and TRL, of the maintenance class of work F1A.

Indirect costs include the overhead charges on labour and stores.

Labour overheads include personnel overheads, such as training, pensions, welfare, and pay group and staff group work; travelling and subsistence; motor transport; small stores; supervision and general administration; and pay weighting (an adjustment for the various grades of labour used).

Stores overheads include local costs of freight and handling; stores motor transport; stores accommodation; and central costs in P&SD of freight and handling; administration; testing and so on.

To estimate labour costs, we need to know the average time expended by faultsmen on a fault report, which we obtain from the engineering works order man-hour return (PID3A) and the telephone plant fault analysis (A51). For control staff on testing and records, a different approach is needed because a large part of the time booked to class of work F1A TRL is booked by non-control staff. So a calculation is made which takes into account all staff employed on fault report reception, diagnosis and distribution, together with the total number of reports handled and the number of effective hours worked.

The average man-hour rate of pay is then used to re-express the time in terms of cost, and the appropriate indirect costs are included by adding a percentage for labour overheads. To arrive at the final cost only requires the addition of the costs of replacement stores and repairs to restore service. Small stores are

included in the percentage added for labour overheads.

At present, maintenance stores costs which appear in the area cost statement only refer to all the F1A class of work. However, a study by THQ Management Services Department has made it possible to apportion the costs of maintaining customer telephone apparatus and to express them as a cost-per-fault report. This, together with man-hour and indirect costs, enables the field maintenance cost-per-fault report on customer apparatus to be arrived at. The table shows a breakdown of the total average cost of a customer telephone apparatus fault report including labour costs for faultsmen and control staff.

Costing for tariffs

Working out the maintenance cost of particular apparatus presents problems, as there is no current feedback of maintenance times and stores for each of the 400 items in the customer apparatus tariff structure. So to compromise, the fault report rate for each instrument is applied to the average man-hours used for each fault report for all customer telephone apparatus. This does not account for the spread of maintenance times for different types of apparatus and, to prevent easily maintainable apparatus subsidising those difficult to maintain, weighting factors need to be introduced.

Field studies are undertaken to determine fault rates of the different apparatus items, and results are usually given for both business and residential situations, as the higher use by business customers usually results in a much higher fault rate. The exercises are far from complete and we appreciate the assistance being received from field staff.

Conclusions

We have looked at the factors in the average cost of a customer apparatus fault report and it can be seen that it is greatly influenced by changes in rates of pay. The result of the steady increases in these rates, together with the effects of increase in stores costs, has elevated the cost of a fault report for 1974/75 to such a level that it is now comparable to the capital cost of some of the simpler types of telephone instrument.

B J Turner, Sv5.3.4 (01-739 3464 x7722)

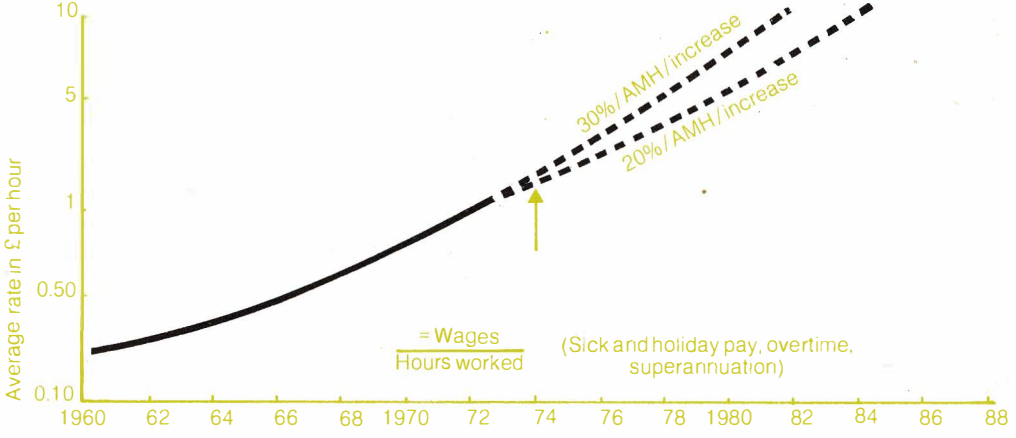
Actual cost of an average customer apparatus fault report

	%	£
Labour (indirect)	47	2.19
Labour (direct)	47	2.19
Stores (indirect)	1	0.04
Stores (direct)	5	0.24
Total	100%	£4.66

Rates of pay

Changes in the rate of pay for labour can have a significant effect on the total maintenance cost. For example, the July 1974 pay awards increased the total maintenance cost-per-hour to an estimated £5.75 (a 23 per cent increase), and it can be seen from the generalised plot of the average man-hour rate since 1960 that the £10 per hour rate is apparently not so very far off

UK average man-hour rate/time



Common control PABXs – problems.

In issue two there was a list given of 13 different types of common control PABX then being considered for connection to the public network. Areas are now having to cope with 22 different proprietary systems. This article discusses some of the problems.

Many systems

One of the effects of introducing a large number of new systems into the network is that it is difficult to develop the expertise necessary to maintain them all. As *TI E5 D2511* shows, it is unreasonable to expect individual TOs to acquire deep technical knowledge of more than the Strowger types plus one family of new PABX systems, or alternatively two families of new systems. One way over the difficulty is to form specialist teams as the penetration of the various types of PABX increases. Some Regions and Directorates already have trained experts in the IBM 3750 system to give effective help and guidance when faults occur that the local TO has difficulty in clearing. Indeed, we may well be moving towards much closer co-operation between Regions, with staff moving freely across boundaries.

In Regions and Areas you may be relieved to know that THQ does not intend to consider type approval for further systems of this generation. And it is surprising to note, that over the years THQ Marketing Department have rejected as many PABX systems as have been accepted.

Training

The Technical Training College at Stone run courses for the LME ARD 561 and ARD 791 systems, the Philips UH200 and UH900, the ST&C P200, and an introductory two week course for the IBM 3750. Shortly they will include the LME ARD 562 and the STC P1000CT systems. In some cases, where there are few systems in use, it may not be economical to pay for a training model and the necessary lecturing expertise: then manufacturers will be paid by the PO to continue training after type approval.

Spares and tools

We intend to buy spare parts in bulk for most systems so that they can be requisitioned in the normal manner; this already applies to the LME ARD 561 system. However, it is necessary to exercise strict control over issues, because maintenance staff tend to order quantities as if they expected failure rates similar to Strowger systems. In the public exchanges there have been cases where local maintenance staff have placed orders for some items greater than that authorised for the whole UK!

Where these common control PABXs use similar equipment to that in public exchanges the piece-parts stocks in these exchanges can be used for PABX maintenance. A snag has arisen, however, in the case of the Pentomat systems. Piece-parts for these were given ST&C (Footscray) codes which were different from the codes already given for public exchange equipment by ST&C (East Kilbride) and ST&C (New Southgate). Extensive checks are needed to verify that only public exchange codes need be quoted. Tools used for ST&C crossbar public exchanges TXK3 and TXK4 can be used also for their Pentomat PABXs. So there is no need for different tool-kits.

Type approved PABXs

For the PO to give type approval of a new PABX system, the system has, in general, to meet all the terms of a document known as a PO requirement (POR) including the requirements specified by THQ Service Department for easy maintenance. The systems approved so far - the LME ARD 561, the ST&C P200 and the Philips UH200 and UH900 - generally meet these requirements. The fault rate has been low, little preventive maintenance maintenance has been needed and, apart from the occasional 'rogue' installation, the quality of service to the customer has been good. And the maintenance man - hour cost is very low. Indeed, the difficulty is that, with so few faults to trace, faulting expertise is acquired only slowly and when a fault does occur it takes a long time to clear.

Trial installations

Areas have most trouble, not with the type approved systems, but with the systems that THQ/Development Department and Service Department have delayed approving. This is because they have not been developed to the standard required. Often extensive modifications are needed and have to be tried in field conditions for several months. There is also the problem that we just cannot stop further installations until we are satisfied. Customers place contracts for large PABXs direct with the manufacturers and assume that full approval will be given before the RFS date and manufacturers cannot hold up their production lines for long periods.

Maintenance aids

For common control PABX systems our policy is one of corrective maintenance, that is, of giving maintenance attention only when service to the customer is affected. So, for large and medium-sized systems we specify that manufacturers must provide systematic means for rapid fault localisation. For systems with more than 1000 extensions any failure in the switching equipment must result in a printout showing the equipment in use when the call failed. Or there must be some equivalent method of diagnosing faults, for example, using meters, as in the case of the LME AKD 791.

For systems of under 1000 extensions the cost of sophisticated fault diagnosing equipment is not justified, but there is a device for monitoring all calls which gives an automatic alarm to the PABX operator if more than a certain percentage of calls or seizures fail. Further aids vary according to the system. There could be a 'fault dictionary' which would attempt to guide a Technical Officer through the stages of a call by stating the various relays held, as in the Philips UH900. Alternatively, the PO may agree to pay for portable testing equipment. Since each tester would be used at several installations, a customer cannot own it.

IBM 3750 system

The IBM 3750 stored program control (SPC) system is interesting in that it is a processor-controlled PABX. Here, the processor controls not only the switching equipment but also the customer's data-handling equipment. Several installations are now on trial with the PO maintaining the switching equipment and IBM the processor, but negotiations are proceeding for the PO to take over processor maintenance in line with normal policy.

The most interesting problem to emerge from the trials so far has been a previously unsuspected side effect of software-controlled processors. In simple terms, it is a near impossibility to get large computer programmes right first time and there are always minor 'bugs' present. This means that modifications are likely to be a feature of the first few months' operation of new installations. Once the initial 'burn in' period is over modifications are likely to be few and far between.

We know that maintenance TOs time and again have to sort out on-the-spot difficulties caused by design inadequacies. We pay tribute to the help and constructive criticism given by all grades of maintenance staff in Areas and Regions. We in THQ will use the data you have fed back to us to get improvements that will make your lot easier.

J D Stoate, Sv5.3.1 (01-432 9145)

Some aspects of congestion in TXK 1.

The TXK1 exchange is a link trunking system, using common control equipment to control the setting up of calls. This has meant that the people involved with TXK1 have had to learn new techniques both in exchange design and maintenance. Congestion is often the first sign that faulty techniques have been used.

Since TXK1 is a link trunking system, calculations of the trunks required for a given grade of service at each stage of switching cannot be made as for Strowger systems. Instead probability theory is used which results in complex statistical formulae. These assume instantaneous testing, and as this does not apply in practice, we are left with a switching network with a traffic capacity better than shown by the specified grade of service. From the maintenance point of view the switching network does not cause anywhere near as many congestion problems as the common control equipment.

Common control equipment is perhaps best looked at in two sections. First, equipment for receiving or sending out pulses - for example registers and senders. A register has to be provided for every call pulsing in, and a sender is needed for every call pulsing out at any one time. Their average holding times, which depend on the number of digits to be received or sent, have to be worked out fairly accurately so that they will be provided in correct quantities. Faulty initial information about the average number of digits to be received or sent has in the past resulted in under-providing registers and senders, resulting in congestion and post-dialling delays. Extra care must also be taken of these items of equipment by maintenance staff. For example, if a sender is busied out, it does not cause the loss of one speech path, but it can cause long post-dialling delays, resulting in No Tone to calling subscribers, on the calls it should have been dealing with during the busy hour.

The second group of common equipment controls the setting up of calls within the exchange - router controls, junction markers, and coders. This equipment is provided not only to carry the traffic but also to give security of service. Take for example junction markers. In many exchanges, only two are required to carry the outgoing traffic. Half of each of the exchange's outgoing routes are dealt with by one junction marker, and the other half by the second. Therefore if a junction marker is busied out for any reason, although the exchange will still have service to all outgoing routes there will be congestion if the outgoing traffic is more than half the busy hour traffic.

Special care has therefore to be taken whenever a piece of common equipment is faulty or is to be busied out for any reason. Ten questions maintenance staff have to ask in this type of exchange are:

Just how important is this piece of equipment?

What other equipment will be affected if this item is busied out?

Can the calls it would have dealt with be handled by other equipment or as second attempt calls without causing congestion?

Is the fault serious?

Does the item have to be busied out and faulted now?

Can it wait until the traffic is lighter?

If there is a choice of item to busy, which one will cause least trouble to customers?

If there is more than one fault, which one is causing the most trouble?

If modifications are to be done, how long will they take?

What is the best time to start modifications so as to miss the busy hour?

It is only now after a few years' experience that the best methods of dealing with some of these problems have been found, and some of the self-inflicted troubles experienced in the early days are being prevented.

We hope that exchange staff will continue to report unusual difficulties or faults using the A646 procedure. If you have had congestion problems we would be glad to hear your views and suggested remedies.

M K Wood, Sv6.1.1 (01-432 1391)

Servicing precision testing equipment.

Many thousands of electrical measurements made every day throughout the PO need to be established within stated degrees of accuracy. To achieve this with any degree of confidence, the measuring instruments themselves need to be calibrated against more precise standards. A valid calibration system provides step-by-step measurement comparisons up to the recognised national or international standards.

Unlike operational equipment, a measuring instrument can become seriously defective without its user knowing that anything is abnormal. Because of this, it is normal practice to repeat initial calibration checks regularly to limit trouble caused on operational circuits by a faulty instrument. Any repairs needed on a measuring instrument should also be controlled by the calibration authority, since its calibration will probably be affected by the repair.

In the PO, the central calibration authority is the Quality Assurance Division of the Purchasing and Supply Department (P&S4.3), an organisation better known for inspecting PO contracts for all types of engineering stores. The specialist knowledge and facilities developed by P&S4.3 to ensure that new measuring instruments are within specification can also be used to maintain the same instruments in tip-top condition for the rest of their working life. This maintenance work is done at one or other of the quality assurance laboratories at Birmingham, Fordrough Lane, or London, Studd Street. Specially adapted vehicles are used to minimise vibration hazards and to make regular collection and delivery trips to all parts of the country. In many instances, instruments can be exchanged on a one-for-one basis with the agreement of the user. This means that he need never be without his measuring equipment.

The P&S4.3 servicing scheme is recognised as a quick and effective method of test gear repair, but the fact that few working instruments retain their accuracy indefinitely seems to be less well appreciated. This reluctance to accept the need for regular checks may be the reason why some users fail to register the location details of each instrument with P&S4.3 as soon as it is put into use.

Designed-in accuracy often accounts for a large part of the price paid by the PO for test equipment. The facilities provided by QA Division clearly safeguard this investment, and also the integrity of the systems maintained by the test equipment. Collectively, our objective should be to ensure that we use regularly calibrated instruments. If you have any suspicion that the registration of one of your instruments has been overlooked, please re-register it now (the P&S4.3 system will take account of any duplication). Conversely, if you have any obsolescent test gear stuck in a cupboard, unused from one calibration check to the next one, why not save PO money and effort by telling QA Division that a routine check is unwarranted and taking local action to have the equipment re-allocated.

Details of instruments covered by the scheme, procedure for registration, and telephone numbers of liaison points are contained in *TI E9 F0020* and *TI E9 F0021*.

E Broadbent,
P&S4.3.2.2 (01-739 3464 x540)

TXE 2 matrix tester to be provided.

The basis for maintaining the new generation of telephone exchanges was conceived some years ago. It was built on the belief that the electromagnetically-operated reed switch was a comparatively fault-free device requiring little maintenance: this subsequently proved to be an over-optimistic assumption.

The switch was used in systems under development as a contribution to maintenance economy. This resulted in little or no test equipment being provided for the small electronic exchange, TXE2. Shortcomings in manufacture worsened problems with reed relay insert failure - see *MN* issue four *Troubles with the TXE2*. It soon became important to locate reed failure accurately and rapidly.

This situation prompted many local efforts to produce testers for switching matrix testing. These ranged from manually-operated testers to testers electronically accessing matrix co-ordinates and controlling relay coil current. Tests ranged from simple go/no-go checks to sophisticated limit tests of reed function timing and of reed contact and associated diode resistances.

Modifications to overcome circuit weaknesses and programmes for replacing reed inserts in exchanges with serious problems are beginning to reveal the true rate of failure in the system. Consequently, there is a more balanced attitude to system maintenance as the performance improves. Changing reed contacts on a large scale to clear individual faults is both expensive and unnecessary. This is particularly true in the switching area of the exchange, where reed relay insert failure is much lower than the overall rate. Also, print-out can be used to locate a large proportion of open-circuit failures.

With better knowledge about the failure of reed relay inserts and with the prospects for improving the performance of new devices to a revised specification, it becomes debatable whether testing facilities are needed for TXE2 switching matrices. The stuck or welded reed contact, the most difficult fault to trace from its symptoms, can be dislodged by removing the unit to test it. Nevertheless, tracing switching area reed relay insert faults can be very time consuming if other areas of the exchange are troublesome or large scale failure has occurred. Because of these problems, it has been agreed that a THQ approved TXE2 matrix tester will be provided.

Maintenance philosophy, economics and equipment practices are three more factors to be considered. The current thinking on TXE2 maintenance is that regular routining should be avoided because it shortens the lives of connectors and reed inserts. This affects the number of testers needed for the system. The number required is also affected by the fact that there are two equipment practices - either one universal tester is needed or one version for each practice.

Having examined testers under working conditions we have decided that the proposed tester should exclude electro-mechanical devices and, if possible, reed relays also. Continuing studies with Telecommunications Development Department should soon produce a useful item of test equipment.

F H Fletcher, Sv6.1.3 (01-432 1401)

Sticking RE relays at TXK1s.

Since the first evidence of RE relays sticking at some TXK1 exchanges a vast amount of work has been carried out by the contractor and the PO. This has spread over two years, and has been geared firstly to establish the mechanism of the causes of failure, secondly to discover means of removing these causes, and thirdly, to ensure that they don't recur in subsequent production.

This article does scant justice to the painstaking tests and observations that have been carried out at more than 50 exchanges; the consultations with chemists and metallurgists; the following up of many alternative lines, and the elimination of false trails.

From close examination at the affected exchanges, suspicion fastened on the white foam gasket material round the edges of the shelf covers. By comparison, other exchanges using brown foam or neoprene foam gaskets experienced sticking trouble to a lesser extent. Laboratory tests were therefore carried out, sealing a dozen or so relays in inverted glass beakers containing strips of the various foams. The relays were pulsed at various speeds, 1pps, 5pps and 10pps, for 10 seconds every minute and the enclosure heated to 55°C. Under these conditions sticking quickly started for all relays - only a few days with white foam, and more gradually for other forms of gasket. Lower temperatures and lower working rates delayed the onset. And no sticking occurred if the relay was not pulsed.

It was disturbing to find that some sticking occurred without including any gasket material at all. This suggested that there were other sources of contamination. Subsequently it was established that certain varnishes on labels and the terylene cloth around the relay windings could also initiate sticking, but much less severe than that caused by gaskets. This occurred on 3000-type as well as on RE relays. To some extent subscribers' meters became affected over long periods.

Work was soon put in hand to determine alternative materials. Further tests suggested that the sticking was partly caused by wear on the residual stud, the copper and copper oxide particles produced by wear being exposed to the volatile components of the various plastics substances. It became evident that these particles between the pole face and residual stud reacted with the volatile, slightly acidic compounds to produce a sticky substance. After thorough cleaning sticking ceased, but resumed under the normal actions of the relay, usually at a faster rate the higher up the racks, where the ambient temperature was higher.

So, what is being done to overcome the problem? First, production methods have been changed to use materials unlikely to give off volatile components. A skinned neoprene gasket is being used to seal the shelf covers. Some further work is being done on alternative materials, shapes and finishes of residual studs and pole faces.

Secondly, at existing exchanges, white foam gaskets on shelf covers are being replaced by neoprene gaskets. However, because in many exchanges the volatile component has been steadily given off over four or five years, it has become absorbed by rack, relay and wiring surfaces - similar to the way clothing absorbs smoke and smells. So it will be a long time before its harmful effects diminish to the stage where sticking can be discounted. Despite improving rack ventilation to clear the volatile components by convection as rapidly as possible, and despite cleaning and replacing armatures, sticking persists. Means of further improving ventilation are being examined.

Thirdly, because it is tedious and laborious to have to clean all pulsing relays every month at each of the 50 or more exchanges most affected, attention has been directed to producing a palliative. Strips of paper have been used but there is a danger here of altering relay timing. So a very thin plastic strip is to be provided to clip over the armature between the pole face and residual, and this should obviate the sticking and avoid

need for cleaning. Many more experiments and trials in exchanges are being run to complete the studies. We would like to record our appreciation and thanks for the unstinting co-operation that has been given by Area and Regional staff to members of THQ. Special thanks go to the investigating contractor's staff, for following up ideas and making test observations. All have helped to identify this very involved and puzzling set of problems. Advice will shortly be given to Regions about ventilating contaminated racks and obtaining the plastic strips.

E V Partington, Sv6 (01-432 9016)

Metering faults.

At the end of the exchange metering system is the subscriber's exchange meter. But how reliable is it? And what kinds of fault affect it?

Meter performance statistics - see *Maintenance News* issue five - show that for every 10000 meters, 16 develop a service-affecting fault each year. Of these 15 lose revenue for the PO. Sixteen is probably an over-estimate; investigation into dubious statistical returns has shown that some exchanges continue to classify meters as being faulty purely on the result of a meter routine test and not from the required test calls under normal working conditions. Routine tests are designed to check items of equipment within restricted electrical limits, so the number of meter failures under these conditions will be higher than when the same meters are checked in normal service. *TI E6 H0010* makes it quite clear that tests under normal conditions are required for the statistics. The TI is now in all exchange files - so do please refer to it.

What sort of faults affect meters and metering? We know about many of them, but if you stumble onto something you think unique, send off an A646 (report of an engineering difficulty) so that we may warn others who may be puzzled about the same thing. The service needs your help in this. You will appreciate that a list of faults that might possibly affect metering would be very long. But for faults that recur again and again it may be profitable to consider them. Indeed, you may perhaps learn from the experience of others.

Common faults

The following analysis was made by one Region, during one quarter, of faults affecting meters under normal working conditions; and in a second quarter, similar results were obtained.

Meters	
Displaced armature	25
Armature spring tension	27
Pawl or detent bent	10
Coil disconnected	4
Wheel jammed	10
Residual magnetism	1
Total	77

Meter rack	
Rectifiers	4
Wiring	18
Total	22

IDF	
Dry joints	64
Jumpers	25
Total	89

Calling equipment	
K relays	58
SW-MY straps	19
Uniselectors	9
Total	86

Subs and line S/S	
Reversals (line + Switch 5A)	35
Total	35

From this table we see that the greatest hazard was dry-soldered joints on IDFs - you will have recently seen posters highlighting this type of fault. Have you checked your distribution frame? Perhaps now might be an opportunity. And referring to the table again, what about the 27 cases of armature spring tension? Did those meters *really* fail on test calls or only during a routine test cycle? Were the springs the true cause of the misoperation or was the pawl-forward-stop binding on the frame of the meter? Perhaps, in some cases, a deft twist of the spring-anchoring bracket with a screwdriver did the trick without removing the meter from the rack for examination. Effective possibly, but hardly conclusive!

Plant Improvement Plan (PIP) 14 looked at a number of factors affecting metering and meter maintenance and yielded the following information:

Findings of investigation	Number	%
Shared Service strapping errors (SW-MY) on 50 point linefinder calling equipment	4770	0.7
Loop-disconnect junctions reversed	302	0.1
Exchanges routining meters at periodicity greater than every 18 months	1586	25.0
TI files without *E6 H0010* (Meter maintenance)	3132	52.0
TI files without *E6 H5151* (Meters Type 100)	716	12.0
TI files without *E6 H5149* (Meters Type 150)	533	9.0
Auto-auto relay sets AT5368 and AT60441 with faulty DD relays	550	1.3
Auto-auto relay sets AT5620 with faulty DD relays	114	1.4
TXK local junctions with Class of Service strapping errors	45	0.7

Since the completion of PIP 14 further cases of strapping errors on 50 point linefinders have come to light and may have been missed during the PIP exercise. However, the revised *TI C4 C3001* containing instructions to advice note jumpering staff may help as it now specifies tests of meters on new lines where in earlier issues it only implied they should be done.

Uncommon faults

These include:

1 Loose positive battery fuses.
2 UAX 0/1 relay set AT60444. Relay D springs 10 and 12 spiking, causing relays J and DD to interact on 'O' level calls and clearing difficulty on '100' level calls.
3 Tariff control eqpt AT5525. Relay DP springs 1 and 2 spiking, holding relay MPB operated. A non-linear resistor 2 should be connected across relay MPB coil tags d and e, and the DP contact examined and changed if necessary.
4 50 point linefinder AT5590. Insulation breakdown between U points 25 and 27, holding relay LFA operated in the control relay set. Contact LFA3 then fails to prevent metering when the selector hunter drives over outlets on which a meter pulse is being applied.
5 Meter 150 AR (positive battery metering exchanges). Rectifier 249A breaks down, resulting in failure of a call to release, accompanied by double-switching of calls to the faulty line. Overmetering occurs during the double-switching and clear sequences.
6 Pay-on-Answer Call Offices. At exchanges where Renter and Public boxes have separate groups of calling equipment, allocation of a line to the wrong group will cause a renter's meter to register coin pulses on '100' level calls which are ticketed by the operator. Hence the renter will be charged twice, and a public call office meter will under-register coin pulses on '100' level calls. This means that there will be discrepancies between the meter reading and the cash in the box. Similar errors will be caused where the 'P' wire from the calling equipment is connected wrongly to the coin and fee check relay set, that is, to the P (or M) or PM wire as shown in the table on the diagram of the appropriate relay set.

You will no doubt agree that faults which affect metering are not at all uniform in their characteristics. However, faults in service can be reduced by thorough automatic or manual routine testing. So keep those routines up-to-date and remember - it's the meter that counts!

L R Tanswell, Sv6.5.5 (01-432 9037)

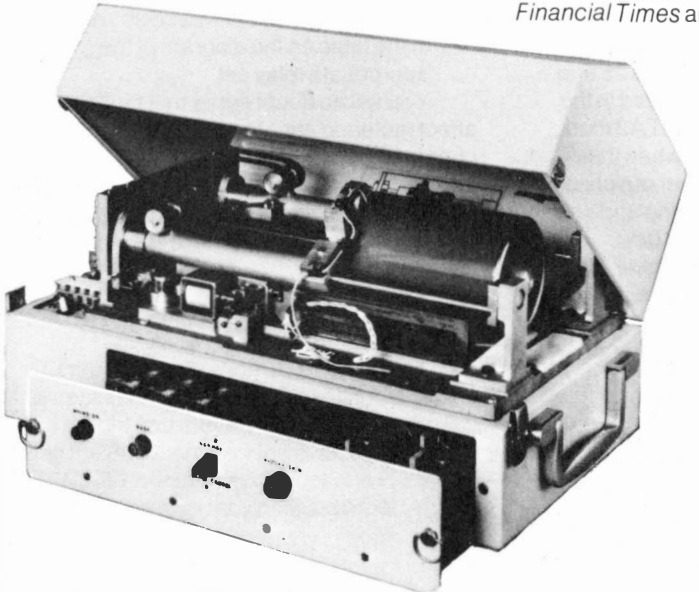
Recorded information services – new equipment

The wind of change has at last found its way into the 16 Recorded Information Service Centres (RISCs) throughout the country. Installation of equipment to replace the obsolete announcer equipment 5A and its associated control and changeover equipment is now well advanced. The new equipment is made up of announcer equipment 11A, which uses as the recording medium a tyre of magnetically loaded neoprene stretched over a brass cylinder, a purpose-built control rack housing up to eight announcers – together able to provide up to six services – and a control unit which gives the recording operator complete control throughout the recording, monitoring and changeover operations.

Announcer equipment 11A

The announcer equipment 11A (figure 1) can provide messages up to six and a half minutes. It is used for services which need frequent changing, such as the *weather forecast* and *motoring information*. Daily announcements, for instance, *recipe*, will continue to use announcer equipment 9A which is a tape loop, playback only machine. The 11A is designed to reduce maintenance costs by using dry-lubricated bearings, not needing routine maintenance. Lubricating the recording drum continuously with silicone fluid is a principle taken from the PO speaking clock; before the recent overhaul of the speaking clocks this method had allowed more than 150 million repeats with negligible wear of the neoprene band or the record/replay heads.

The announcer equipment 11A has two heads, an erase head and a record/replay head. These have a very long life if pressure on the neoprene band is correctly adjusted and the band is silicone-lubricated. 11As have been used continuously at the London RISC for over two years and apart from minor design weaknesses (work is in hand to overcome these) they are proving to be reliable and are giving good quality announcements.



Control equipment

The control rack is a standard size – 10ft 6½in by 4ft 6in – and, as well as providing space for up to eight announcers, houses all the necessary equipment for six services. Flexibility is provided by a 6 x 8 matrix using type 25 reed relays. To enable up-to-date information to be recorded and distributed to customers as quickly as possible a remote recording facility similar to that provided for the *Financial Times* and *London Weather Centre*

on the way.

will be available in the future. This allows recording operators at remote studios to record direct on the the announcers and requires no engineering help. PO traffic staff will vet the announcement and switch it into service. The front panel of the recording operator's control unit is shown in figure 2.

The new recorded information services equipment was subjected to a thorough test during the summer of 1974 when it was used at the London RISC for the *Test Match Information Service*. The announcements on this service are changed very frequently and the design of the equipment was praised by both the operating staff for being simple to use and by the maintenance staff for its reliability.

Distribution problems

Adjusting the levels of recorded announcements is a problem which has been investigated thoroughly over a recent twelve months' period. Aligning amplifiers for the correct output levels is simple in the case of steady state since wave signals but for the recorded information services the signals are of complex speech or music waveforms. Here, accurate adjustments are difficult to obtain. The investigation revealed that announcement levels were higher than those specified on the adjustment card THQ 2084. This resulted in serious speech and music distortion.

New levels for amplifier outputs were determined and amendments have been made to the card; as shown in figure 3.
It is available from THQ/Sv5.4.3. on request.
The procedure for readjusting recorded announcement levels was initially detailed in THQ Circular E1/74 issued in January 1974, and has since been covered in re-issued TIs.

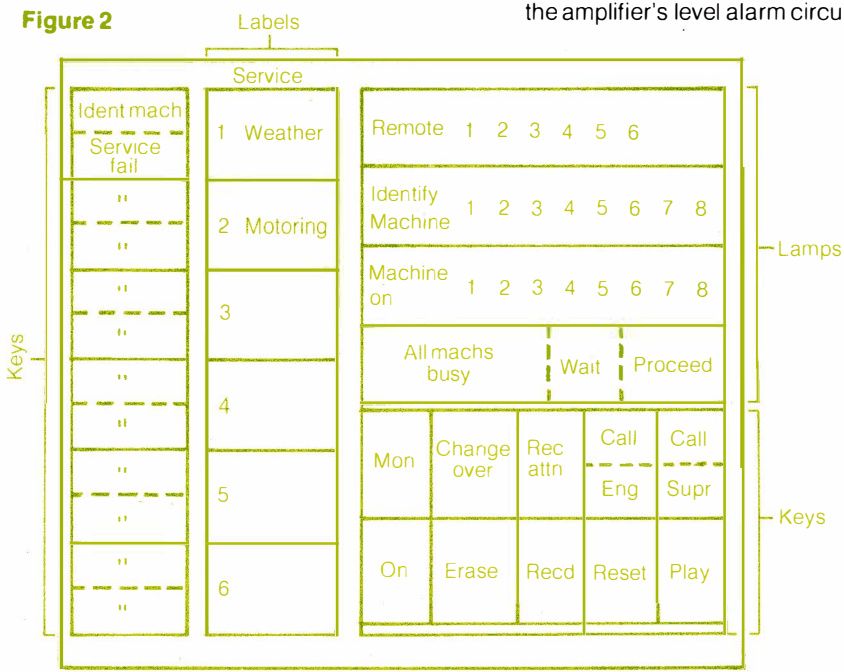
We are looking at a proposal for recording a steady state tone at the end of the announcement. The tone, of controlled level and frequency, would last a second or two and would allow the distribution amplifiers to be accurately adjusted.

A new high quality, solid state amplifier (Amplifier 224A) designed for the recorded information service distribution networks is expected to be available by the end of 1975.

Power supplies

A common error is being made in measuring the ht voltage supplied by the power panel to the distribution amplifiers. To operate the amplifier's level alarm circuit, 250 ± 5V

Figure 2



is needed. This is a *dc* potential but it is often wrongly measured using the ac scale of a multi-range meter. This results in a false high reading. The subsequent re-adjustment of the transformer tappings of the power panel gives a dc potential below the 245V lower limit and makes the alarm circuit unstable. But remember, that the 6.3V supplied to the valve heaters by the power panel is an *ac* potential and therefore the ac scale of the multi-range meter must be used.

Routine checks

Output levels from the RISCs are kept as constant as possible. As slight variations can occur when recordings are changed, distribution centres should make regular routine checks of announcement output (*TI E6 RO201*) and of the ht supply (*TI E6 RO210*). These simple checks will mean that distribution centres have done all they can to provide announcements that are clear and are at a satisfactory level, as well as providing the conditions for the distribution amplifier alarm circuit to function correctly.

J McAllister, Sv5.4.3 (01-432 1358)

Figure 3 THQ2084

Test	Meter reading	
	Min	Max
Amp. O/P		
Speaking clock	5	7.5
Information services	5	7.5
Test position alm.cct.	14	16
„ „ Amp. V1. Ic	12	18
„ „ Amp. V2. Ic	12	18
H T Volts	18	19

Improving

Telex service signals are used to tell callers when and why calls cannot be successfully completed. OCC is sent, for example, when a called line is engaged, ABS for a closed station, DER means station out of order, and NC means no circuits or plant. These signals are generated centrally in each telex exchange and are distributed to the racks of equipment through relay-sets. These contain repeating relays, spark quench and interference suppression circuits. A high standard of maintenance is essential for these important common services, as a single failure can affect many customers.

Generating the signals

Originally service signals were produced by electromechanical generators, which needed frequent adjusting and cleaning. An electronic replacement, the signal generator 6A, has now been provided at all exchanges, although some mechanical generators remain as standby machines at certain exchanges. This has meant that not only are signal supplies more reliable, but that the replacement has virtually eliminated the need to clean and adjust generators every fortnight.

Distributing the signal

The present signal distribution relay-sets use a mechanical 2B type polarised repeating relay which requires regular preventive maintenance. The contacts on these relays tend to deteriorate fairly quickly if they are

telex service signal equipment.

subjected to heavy overloads resulting from transient earth or battery conditions. Such faults can be difficult to locate especially in larger exchanges where signals are fed to many racks of equipment.

Experiments at a large exchange confirmed that by fitting a protective device, fused resistor 1A, in service signal leads on each equipment rack, the effect of fault conditions was reduced and the life of signal distribution relay contacts was prolonged. Subsequently all new racks of exchange equipment were supplied with fused resistors in each service signal supply lead.

A resettable miniature circuit breaker, circuit breaker 6A or 7A, with an alarm facility, is now available, which gives better protection against overload conditions. This device is likely to be specified for new equipment and may also be fitted retrospectively if the costs can be justified.

It has long been thought that solid state circuitry could replace distribution relays but there were no components that could withstand ± 80V signalling voltages, high signalling currents, and transient heavy overload conditions. A design has however now been tried successfully at two exchanges, and we hope to order some of these 'relay-sets' to replace the existing design. This change should improve still further, the reliability of signal supplies, and the present need for preventive maintenance on distribution relays will be eliminated.

These improvements can only lead to a better service to our customers and a reduction in the number of 'no signal' fault reports.

M Sullivan, Sv6.4.2 (01-432 1318)

Have you got an aerial?

Subscribers Apparatus and Line faultsmen who maintain overhead plant as part of their normal duty should have a tester 132B and an aerial 32A. These are used for locating disconnections in drop-wiring cable by tone-testing. The TI about it - *E2 C1055* - was issued in April 1974 and Areas were asked to requisition the aerials. Following a recent awards case we have found that some staff may not have aerials. If you haven't got one, ask your supervising officer about it and consult the TI on how to use it.

D Ansell, Sv5.1.1 (01-432 1373)

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 4034 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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