Maintenance News

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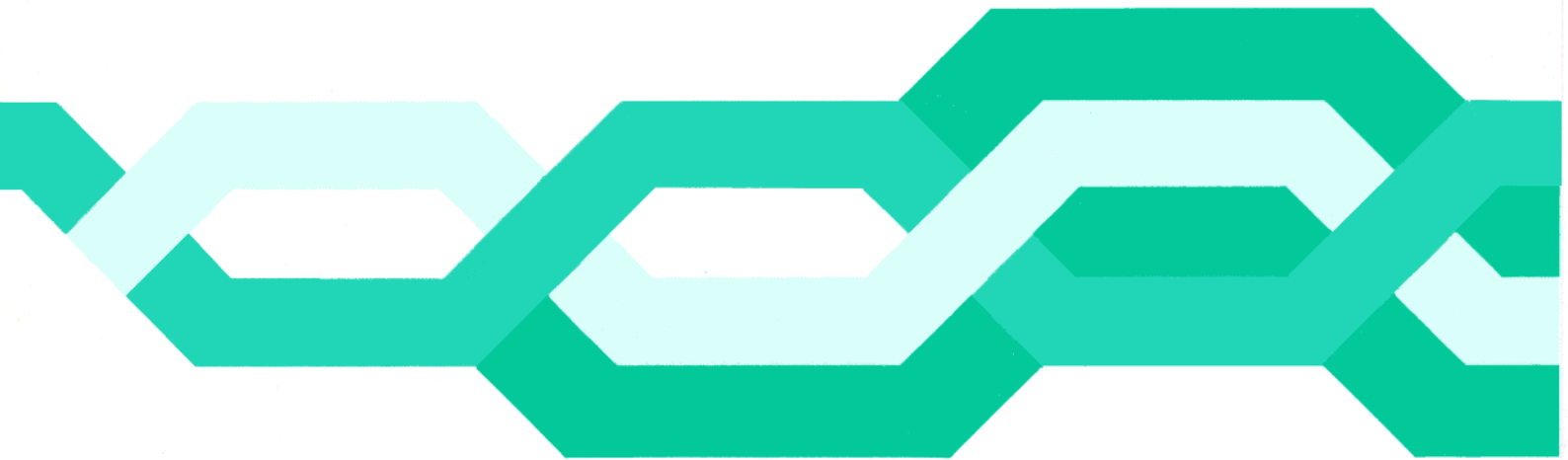

For British Telecom staff only

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Maintenance News

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

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Editorial

One of the gratifying things about being the editor of a magazine such as this is that people actually read it! What is more, they get very upset if they do not receive their own copies.

Fortunately, in spite of the two reorganisations of HQ since *Maintenance News* emerged as a medium for Service Department, the powers that be have continued to acknowledge the value of this magazine. Personally, I feel MN will play an even greater role with the impending demise of TIs. Already we are seeing 'newsy' items appearing in *MN* which otherwise which might have been printed in TI format, and distributed to many inappropriate files – a point brought out by Brian Grover in this issue's On Reflection . . .

To return to my starting point, we try to make *MN* as readable – and as accurate – as possible. Points on which your editor has been taken to task – on abbreviations by one correspondent, and by an observant reader (obviously an RSC man) who pointed out that the photo on page 29 was printed in reverse!

Distribution errors do occur, I'm sorry to say, but it would assist me if queries could first be made to local distribution duties, as they can often sort things out. There are always enough copies to go round.

– Editor

Microphonic noise in Strowger exchanges

by **Rob Goundry** BTM/SM3.1

Microphonic noise – the name given to electrical noise caused by mechanical vibration – has always been a problem in Strowger exchanges where the connection from one customer to another is dependent on the sliding metal contact between wipers and banks, open relay contacts, *'u'*-points, and the like. All of these contacts are subject to the ravages of atmospheric pollution, airborne dust particles and quite severe vibration when selectors step, hunt and release. That the system works as well as it does, is a credit to those in the past who specified, designed and built it and all those now involved in its maintenance. The system designers did their job thoroughly. Reports in our files detail tests using a wide range of different wiper and bank contact surface metals including gold, stainless steel and rhodium. Wipers with oil damping to reduce vibration were tried, and even the use of PTFE as a wiper/bank contact 'lubricant' was investigated. The materials chosen as standards by our predecessors were a compromise between the purchase price and the cost to maintain a given standard of service over a long life.

Why the interest now?

Few changes have been made to the design of 2-motion switches over the years, so why is noise in Strowger exchanges now looked on as a growing problem? The most likely reason is the improving performance of the network brought about by modernisation, rather than any widespread slipping of maintenance standards. In this new environment Strowger can 'sound' comparatively poor – a fact frequently brought to our customers' attention by radio phone-in programme presenters. Although the number of calls broadcast on radio is very small, an audience of several millions hears the DJ complain of another 'poor line'. This is a significant factor in forming and establishing our customers' opinion of our service. Noise levels that were tolerable 40 years ago – when 2000-type switches were designed – are becoming less acceptable in the 1980s; not only to voice services but also for data traffic. Noise during data transmission can corrupt information and, if it occurs frequently, results in the need for proprietary error-correcting equipment. Thus some of our more important customers can lose confidence in our services and may be put to extra expense. Our customers' sensitivity to faint and noisy calls is very evident in initial results from TELCARE – Telephone Customer Attitude REsearch, the scheme in which our customers are asked in a telephone interview to comment on our services. Figures for both local and trunk service indicate that many customers have difficulty hearing or being heard because of faint or noisy transmission, and this is clearly a cause for concern.

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Noise sources

What are the sources of microphonic noise in a Strowger exchange? Banks and wipers immediately come to mind, but there are quite a few other common causes – as listed in TI *E6 D 0014* – and summarised here:

- Line wipers – dirty or having excessive tip wear and gap.
- Line switching relay contacts – lack of tension and block lift,or dirty.
- Line bank contacts – dirty or tarnished.
- Line wiper cords – high resistance terminations and suspect continuity.
- 'U'-points – dirty or tarnished contacts, depth of engagement inadequate.
- Selector seating – incorrect alignment with bank, loose cradle/rack shelf cross-member screws.
- Selector covers – in contact with adjacent covers thereby transmitting vibration.
- Wiring – spurious connections between the circuit and frame.

Prevention better then cure

Recent investigations in several parts of the country have confirmed that there is no quick and easy way to reduce noise. Knowing the common causes helps to locate faults – but prevention is better than cure. This is largely a matter of keeping the switches in good condition by routine maintenance. The frequency of routine work can best be assessed locally in the light of experience with a particular exchange.

Solution

Implementing schemes to reduce noise is clearly a formidable task – given that there are over a million 2-motion switches still in service. At this late stage in the life of Strowger most ideas are not economically viable, although the recently published change to wiper tip gap adjustment limits is a notable exception. Wiper tip gaps should now be set in the range 14-18 mils. This means that the adjustment range has been tightened up by 2 mils at each end. This approach should result in the same 16 mils average tip gap as before, so avoiding any possible bank wear problems that may have arisen if only the top limit had been changed. A wire gauge – Gauges Feeler No 35 (item code 14 1683 in Section 5TB of the vocabulary of stores) – is available to enable checking of the new adjustment. This tool has both 14 and 18 mil gauge wires projecting from the same end, thereby making the job a little less tedious than with the 12/20 gauge. The new adjustment will take a full routine cycle of three years or so to become applicable to all switches. The resulting (hoped for) reduction in noise will therefore be progressive. Re-bladed wipers from Piece-parts depot (PPD) will shortly be supplied adjusted to the revised limits, and adjustment of new wipers is being pursued with the manufacturers. It is worth mentioning that we would not have to buy new wipers if sufficient were returned for refurbishment – *so keep those old wipers rolling in to PPD!*

In practice it is not always possible to complete preventive maintenance as often as we would like – and noise will arise randomly from items such as line relay contacts which are not subject to regular routines. It is inevitable therefore, that some switches will become prone to noise. The task for maintenance staff then becomes one of minimising the number of such switches without taking too much effort from preventive work. Some automatic assistance in locating those noisy switches would be useful, but all previous attempts at designing a practicable and economically viable add-on "noise detector" for routiners/call senders have been unsuccessful. An earlier article (*MN6* p24) recorded the outcome of a major effort in this direction between 1968 and 1974. On a much more positive note, we now have MAC – the system of Measurement and Analysis Centres (see *MN21*) – to help us. MAC tone detection and identification is achieved by a combination of 400Hz and 1000Hz tone detectors providing inputs to the MAC processor. There the program enables the tone presented to be identified by its cadence. Although tolerant of noise in both detection and identification, MAC will not resolve a tone in the face of severe noise on the line. In such cases, MAC is likely to record the call as a plant defect in the 'unrecognisable result' (UR) category. MAC 'UR' results can therefore be looked on as a rough measure of the incidence of 'noisy' calls. In the case of MS1 (measurement sequence 1, own exchange test calls) this is a measure of noise for individual exchanges. It can only be a 'rough measure' as some noisy calls will not affect MAC at all, and others can be

classified as UR for reasons other than noise. The following article "Recognising the unrecognisables" gives more detail on the MAC tone identification system and describes some of the more common causes of URs.

A quiet life

As the network becomes progressively quieter with the provision of modern switching and transmission systems, pressure to keep Strowger quiet will increase.

So be aware of the importance of microphonic noise:

- its causes
- the need to prevent and cure it
- the use of MAC to indicate its incidence and
- the use of MAC analysis sequences to assist in locating it.

Most of our customers would be satisfied with a quiet life, so let's make sure they get one – well, at least from your Strowger exchanges!

Strowger Regional Service Improvement Centre – a national service provided by
BT Midlands HQ
(021 643 5048)

MAC–recognising unrecognisables

by **Bill Collins** LES4.1.2

Measurement and Analysis Centres (MACs) are now installed in all Areas to measure the quality of service given by the public switched telephone network (PSTN). Patterns of test calls are made on various parts of the network and the results of these calls are recorded and used to compile performance statistics for exchanges, Areas, Regions, and so on. Detailed fault information is also available to exchange maintenance staff including, for example, individual failure files (IFFs), and analysis sequence results, which can be obtained as required from the local MAC staff.

To carry out these measurements the MAC processor must be capable of identifying calls that successfully receive test number tone (TNT) from answering equipments used by MAC, or that receive a supervisory tone, such as busy tone, number unobtainable tone, and such like.

A combination of hardware and software design is used by the processor to decode these various tones and record them under their correct categories. But if the tones or conditions received on a call cannot be identified, the result of that call is recorded as 'Unrecognisable' (UR). A brief description follows of how the processor defines a UR and of various causes found for UR's in the network.

Tone recognition on MAC is carried out in two stages—

- Hardware: TNT and supervisory tones are received by filters in the special interface hardware (SIH) at the MAC centre and reported to the processor using on/off delay timers. These timers prevent transient interference conditions from being reported to the processor.
  1004Hz tone (which is part of MAC TNT) is detected by a narrow-band filter and has transmission tests carried out on it with selected calls – about 1 in 20 of all calls generated by the MAC.
  400Hz tone is detected by a broad-band filter with a frequency response of 300 to 500Hz. This broad band is necessary because of the wide frequency variation on 400Hz supervisory tones and ordinary TNT (not-MAC generated) found in the network.
- Software: Outputs from the filters and delay timers are recorded in software by the processor during a 6-second tone decode period, known as the 'seek match' period. This seek match period is compared against a cadence table – specified in software – of all categories of tones that the MAC is required to detect. The table takes into account the timing tolerances to be found on the various tone supplies. If the tone durations recorded in the seek match period fall within the tolerances of a tone category specified in the cadence table, then the result of that call will

→

be recorded under that category, for example busy tone, ring tone, test tone, and so on. However, if the seek match period does not compare with any of the categories in the cadence table, the processor records the result of that call as 'unrecognisable' (UR). In other words the processor has received a call result that falls outside all known parameters for TNT and supervisory tone supplies and therefore cannot identify it.

Causes found for UR's

As plant defects – such as number unobtainable (NU), no tone (NT), or ring tone (RT) – were gradually improved in exchanges due to action taken on MAC results, with some exchanges it was noticed that there was no corresponding improvement in the level of UR failures. In fact, with some exchanges the URs appeared to get worse. Although a possible explanation for this was that as the other faults were cleared, URs were being revealed, it was necessary to identify the causes of these URs.

Inland Division's MAC Operations Group and MAC staff in various Regions and Areas, carried out special investigations to find out the causes for specific UR failures and to check that the processor handling of tone recognition was correct.

The results of these investigations showed that there was no single cause for UR failures, but they could, in fact, be divided into a number of main fault headings –

☐***Double switching to conversation*** – found to be a main cause of URs. The broad-band 400Hz filter, referred to earlier, will detect speech frequencies within its band and cause random speech-induced outputs to the processor. The processor will be unable to identify these as a legitimate result and will therefore record a UR.

☐***Noise*** – another main cause of URs – was proved to bank and wiper noise on Strowger exchanges, although other causes were found on all exchange types, for example high resistance (HR) connections, faulty spring-sets, faults on crossbar switch fingers, and so on.

The 400Hz filter will detect noise (which has frequencies within its response band) and cause spurious outputs to the processor, similar to that described above. However, the processor is tolerant of short duration noise and only if the noise is loud and long enough in duration will the call fail as UR. Subjective tests have been carried out to set the tolerance at such a level that only noise considered to be unacceptable on a customer's call will lead to a UR, which is the correct result.

(The previous article in this issue deals with causes of switching noise on Strowger exchanges.)

☐***Miscellaneous tone supply and network faults*** were proved to out-of-tolerance ringing machines, tone supplies in contact, faulty PCM channels, and excessive 400Hz attenuation in the network. (The MAC tone detectors are designed to respond down to −35dBm as measured at the access equipment exchange outlets).

Low frequency interference faults on exchange power supplies have also caused URs during MAC tone detection. These are now identified by routine noise tests carried out by the centre staff who arrange for any faults to be cleared.

☐***MAC equipment***

During the implementation phase of MAC it was found that the processor was not tolerant enough of short duration switching noise. This has now been improved while ensuring that double switching (speech) faults are still detected. Other minor system interworking problems also came to light, which have been cleared by software modifications.

By the time this article is published the most up-to-date tone recognition software will have been proved and loaded on all MACs.

Identifying URs

It is not possible to determine retrospectively the reason why a particular call has failed as UR. This is because the processor cannot record the difference between such obscure failures as faulty tone supplies, and noise and speech frequencies ringing on the MAC filters, for example. It is therefore necessary, if the UR failures on an individual exchange are relatively high, to carry out a special investigation to determine the causes for specific URs.

Experience to date has shown that a high failure rate on an exchange will usually prove to be in one of the main fault categories referred to earlier.

It is recommended that UR special investigations are carried out with the assistance of the local MAC staff. They have the necessary information and facilities available to advise on the best approach. For instance they have up-to-date failure patterns, additional call sending facilities (AS2), special test programs and the experience of dealing with similar problems on other exchanges in the Area.

So if you are having difficulty in getting to grips with URs on your exchange, you are advised to have a word with your MAC staff to identify the causes.

All staff involved with the operation of MACs at IDHQ, Regions and Areas, constantly monitor the performance of the MAC. If any changes or improvements are considered necessary they are implemented speedily to ensure that the MAC continues to give a reliable and accurate measurement of the service given by the PSTN. This also ensures that failures are quickly brought to the attention of maintenance staff who have to find and clear the faults.
(01-432 2074)

Building services—control for the 80's

by **Mark Hindley** ETA5.2.1

The continuing increase in energy costs and the environmental needs of current telecoms equipment, make accurate and effective control of building services equipment essential. One method of improving control is by the use of a 'Centralised Control and Monitoring System' (CCMS).

The benefits of the system are closer control, more effective use of energy and better maintenance. To gain experience of this type of control system a field trial, involving 17 buildings, is under way in Leicester Telephone Area.

As outlined in figure 1, the basic concept of the CCMS is to collect information on conditions, plant status and alarms in remote buildings and transfer this information to a central control for processing. The information can be used for monitoring purposes, or it can be used in programs to control the operation of plants in the remote buildings.

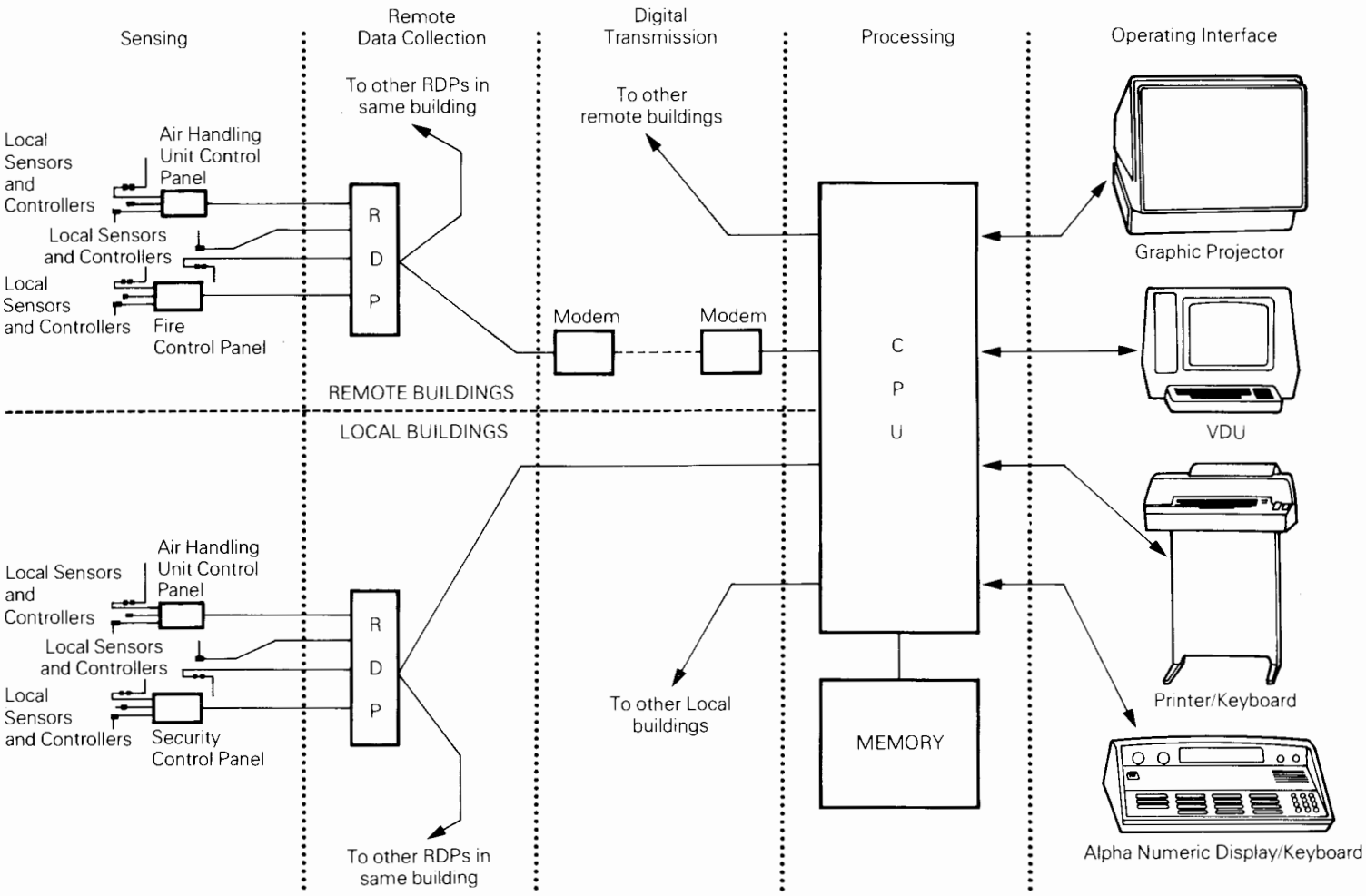
Situated at the control centre in Leicester (Cardinal) exchange is a central processor unit (CPU) with associated visual display unit (VDU), operator keyboard and printer. Information is displayed by the VDU and printer either by request, or automatically in the case of alarms. The operator can request further information, to analyse a situation, and control plant by use of the keyboard. The VDU and keyboard are also used to program the system to react automatically to changes in condition at the remote sites. The printer can also print out data at timed intervals or when plant is switched on or off.

At each remote building are a number of data gathering panels (DGPs) which are connected to existing plants to collect information and allow control as required. The DGPs convert information into digital form and send it through a transmission loop and datel links to the CPU. Any control commands issued by the CPU are transmitted by the same method to the DGP which interprets the command and operates plant accordingly. Each DGP can be used for up to seven control functions and 20 monitoring points.

Monitoring

The CCMS allows constant monitoring of building temperature, humidity; energy usage; plant status (on, off); and alarms. This is achieved by using suitable sensors or relays or, in the case of electricity and gas consumption, by using specially fitted meters, giving a pulse output related to consumption. This information, coupled with the control capability, allows close control of building conditions and accurate monitoring of when and where energy is being used. In addition, the immediate notification of any alarms results in a faster response to faults, reducing out-of-service time and consequent problems with telecoms equipment and staff discomfort. Information on plant running times can be used to automatically indicate when →

Figure 1. Typical Centralised Control and Monitoring System



maintenance is required – avoiding unnecessary routines.

Control

There are three types of control program available –

- Standard Control program
- Control Interpreter Language (CIL) program
- Time Control program

☐standard control programs are those supplied with the system and cover such things as optimum start control for heating systems; maximum demand control of electrical supplies; and duty cycling control for ventilation and air conditioning systems. These programs are ready for use and will control plants automatically once the necessary equipment information and control parameters are entered.

☐CIL programs are tailor-made to suit a particular control need: they are written and entered by the system operator. They allow complex or unusual control problems to be overcome and introduce a flexibility that allows the system to be developed in an innovative way. These programs are used to control boiler firing rates; selection of heating stages, with reference to outside air temperature; control of heating zone valves, with reference to room temperatures; control of ventilation and air conditioning for staff comfort during occupation, and equipment protection at other times.

☐time control programs are used to control rack lighting in exchanges, security lighting at Telecom engineering centres (TECs), domestic hot water services and other equipment benefitting from time-related control.

Fire and security

The CCMS also provides automatic fire and security monitoring systems. The building security package includes automatic building access control for entrance doors, timed report facilities for security teams and, a recent addition, closed circuit tv capabilities.

Benefits

The CCMS facilities allow a complete building management system to be provided. This can control all of the main functions of one or many buildings. The system not only improves environmental control, plant performance and building security, but also ensures considerable savings in energy and maintenance costs. (0533 29896)

A man's home is his ..college

by **Richard Harris** BTTC/IT7.3.8

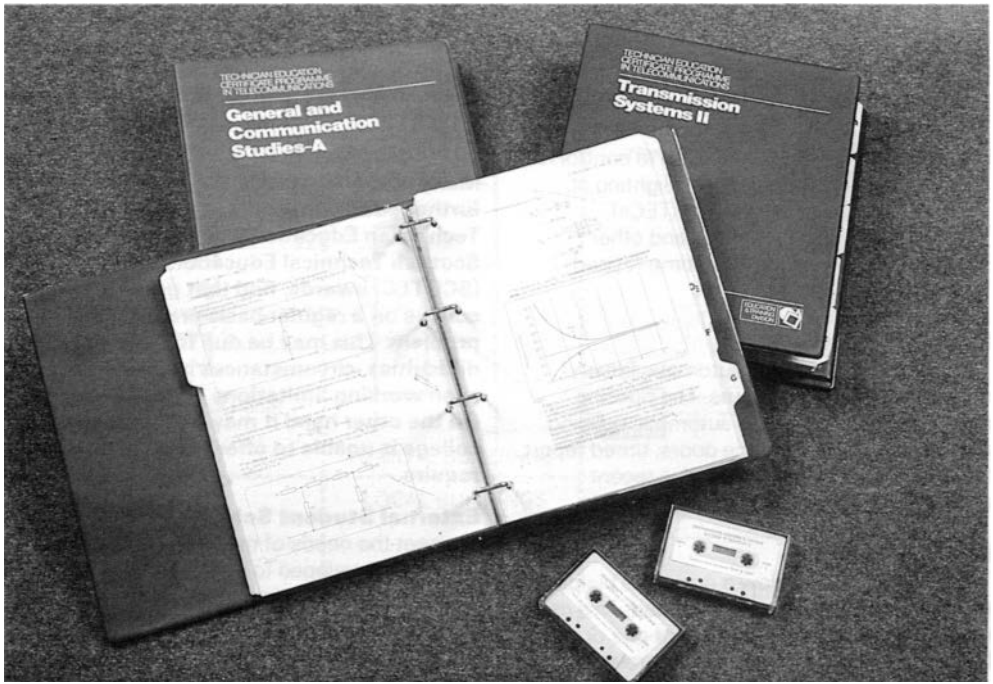
Many potential students who wish to attend further education courses leading to Technician Education Council (TEC) or Scottish Technical Education Council (SCOTEC) awards, find that getting to a college on a regular basis presents a problem. This may be due to geographical difficulties, circumstances in the home, or even working limitations such as shiftwork. On the other hand it may be that their local college is unable to offer the course they require.

External Student Scheme

To meet the needs of these students a scheme has been developed to enable them to study at home, and at times to suit themselves. This scheme, known as the External Students Scheme (ESS), uses learning packages, and is run in co-operation with 35 participating colleges.

Learning packages

Each learning package is written to the objectives of a TEC/SCOTEC approved syllabus and therefore contains all the information students need to succeed in their course of study. It is similar to a correspondence course in that students are their own masters, choosing when and where they wish to study. However, in the case of the learning packages, students are allocated a tutor to guide them through their course. →



Example of learning package

At present there are eighteen subjects covered at levels 1, 2 and 3. The packages, which are the result of years of careful product design, are written at the BTTC, Stone, by a team of specially-trained authors. The administration, illustrations, printing and distribution are undertaken by BT's Harrogate-based reprographic services group in co-operation with the Old Street Illustration Studios in London.

A learning package is divided into sections, each of which consists of a number of convenient working units – known as segments. Each segment is a lesson in itself and is designed to take approximately one hour to study. Some of the segments include audio cassettes which are particularly useful for demonstrating such things as tones, or the effect of restricting bandwidth on frequency response. At the end of each segment self-assessment questions are provided to enable students to test for themselves how well they have understood that particular part of the course.

The student receives the learning package in three separate issues, each with homework which is submitted to the tutor for marking.

Applying for a course

Students wishing to take advantage of the scheme must apply through their Area Training Officer (ATO) who vets the applications to ensure that this is the most suitable mode of study. The ATO then advises on the course that best suits the student's needs, arranges enrolment with a college that participates in the scheme, and forwards the papers on to Harrogate for processing. The college selects the tutors and deals with the general administration. If a college is not available, the scheme is wholly administered by BT who will also arrange independent tutors.

The tutor's role

The tutor guides the student through the course, marking homework and holding 'face-to-face' tutorials, during which advice is given and difficulties explained. A tutor may also be available at pre-arranged times for students to seek help by telephone.

At any stage of the year the tutor can arrange for a student to attend a 'remedial' tutorial should homework indicate a student is in difficulty. These may take place during the day or evening and are organised in conjunction with the student's supervising officer.

Assessing performance

During the year, at levels 1 and 2, students undertake in-course tests – known as phase

tests – followed by an end of unit test. These tests are prepared by the authors at Stone and moderated by TEC before use, although colleges may use their own assessment material if they so wish. The tests are invigilated locally and held either at the student's nominated college, or at a centre close to his place of work. At level 3, special homework assignments are used in place of the phase tests.

After marking, the tutor sends the results (which may include guidance) to the student. In the event of a borderline result the papers are examined by a TEC moderator who, taking into account the student's homework and tutor's recommendations, gives the final decision on the student's result.

The ESS has to allow for a number of differences between the TEC and SCOTEC administrations. For example, TEC is not an examining body and the course assessment is set by the colleges, or BT, with the overall result being dependant on the results from all the phase tests and the end test. With SCOTEC however, it is their end examination, similar to the former City and Guilds examination, that determines the grade awarded to the student. A TEC student may be awarded a fail, pass, pass with merit or distinction, while the SCOTEC student is graded from 1 to 10.

The record of success

An analysis of the results achieved in 1980/81 indicates a remarkable success rate for the scheme. Over 6000 packages were distributed from which the results were . . .

Level 1 . . . . . 74% successful
Level 2 . . . . . 72% successful

There were very few cancellations and withdrawals at either level.

Policy

The policy is set by IDHO/IT5 in London, who co-ordinate the scheme with Regions/Boards and the TEC. They also monitor the performance of external students to produce national statistics and to develop policies which best meet both students' and BT's business interests.

The path ahead

- BT is confident that the scheme has all the qualities to justify it being regarded as a model for wider national application. Learning packages are being purchased by an increasing number of college lecturers for use as a guide on the depth and standard of their own tuition.
- The revision of the City & Guilds Telecommunication Technician Scheme, in which substantial TEC material has been adopted, will make a number of the existing learning packages suitable for overseas students studying C & G courses.
- Taking advantage of modern technology, a method of providing tutorial facilities between tutors and remotely-situated students is undergoing trial in Aberdeen North. Known as *Cyclops*, it is a two-way electronic blackboard linked by an ordinary telephone line, and saves tutors and students from having to make long and time-consuming journeys to tutorials. Yet another example of distant learning, and, one step closer to taking the classroom into the student's home . . .

(0785 762690)

NITE shift

The introduction of a New International Tariff Equipment (NITE)

by **Bob Stroud** LES 4.1.1

The need for improved flexibility in the charging of customer dialled calls is of importance to British Telecom in a competitive environment. To meet part of this need a replacement tariff equipment has been developed and is being installed at all exchanges concerned with the generation of tariff pulses for the charging of international calls.

Old and new

The obsolescent equipment consists of Machines Pulsing 23A and Tariff Control Rack (AT 5525). The Tariff Pulse Distribution (TPD) racks are being retained and modified for distribution of pulses from the new equipment.

The new International Tariff Equipment Control Rack (ITECR) consists of microprocessor-controlled Equipment Pulse Generating 3A (EPG 3A) and Equipment Distribution 1A (ED1A).

Equipment

The NITE is a pulse generating system composed of two asynchronous generating sections operating in a main/standby mode. Each section consists of an EPG3A and, depending upon the load imposed by the call timing equipment (see Loading), one or two shelves of 15 short 62-type Pulse Distribution Units (PDU).

Provision is made for connection of pulses from one section at any given time. This, and →

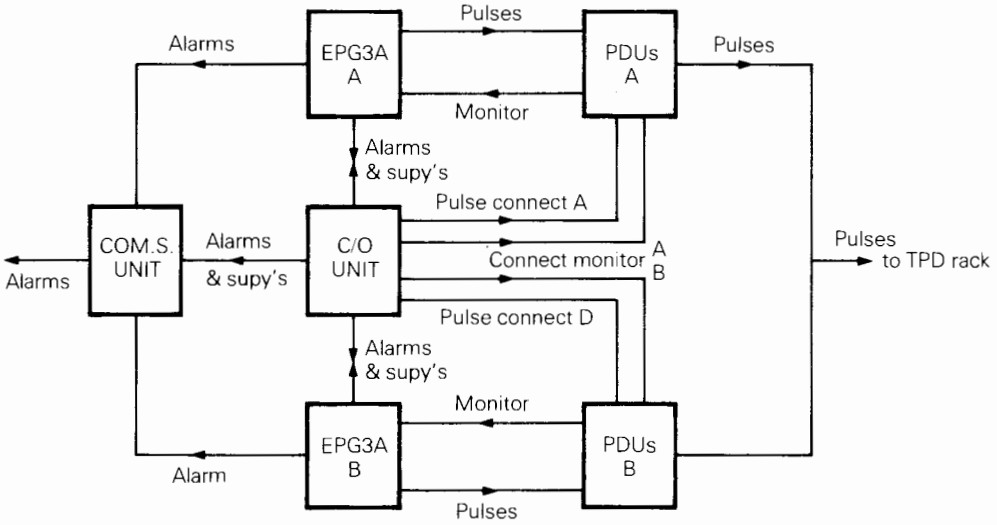


Figure 1. International Tariff Control Equipment ('A' on line).

pulse monitoring of both generating sections, is controlled by a changeover unit (c/o.u) under instructions given by the EPGs. Alarms are initiated by a Common Services Unit (COM.S.U) which acts upon instructions given by the EPGs or C/O unit.

An explanatory diagram of the system is shown in figure 1.

Pulse generation and distribution

The EPG3A contains a 5MHz crystal oscillator (10MHz÷2) for its timebase. The microprocessor, which can be instructed from a keyboard to gate information to an LED display, operates under the control of the executive program held in EPROM. Tariff information, which is held in an electrically erasable programmable read-only memory (EEPROM) is sent to the EPG's associated Pulse Distribution Units (PDUs) under control of the microprocessors.

Each of the EPG's associated PDUs convert earth pulses into two battery pulse outputs to the TPD rack.

The EPG3A's in-built 'watchdog' and 'checksum' circuits provide hardware and software checks to ensure the tariff information being sent is valid.

Loading

Each PDU is capable of sourcing up to 10A per supply (2×5A outputs). Typically, for each of 15 supplies available, output 1 serves odd numbered racks and output 2 serves even numbered racks. Where the 10A sourcing capability is insufficient to meet the demand imposed by the call timing equipment, a second distribution equipment (Auxiliary ED1A) is provided. The outputs (2×5A) from each PDU are commoned and, typically, outputs from the first ED1A (Main) serve odd numbered racks, outputs from the second (auxiliary) ED1A serve even numbered racks.

Facilities

The EPG3A can deliver up to 15 pulse supplies each at four different charging rates. Any one of 64 available day programmes (tariff patterns) may be allocated on a 24-hour basis to any pulse supply or supplies. Each day programme allows up to eight rate changes per day which may occur on the hour or half-hour. Pulse rates may be selected from the range 600ms to 60 seconds at 50ms intervals.

Special day programmes required to operate for one day, such as the changeover from GMT-BST, cheap rates for bank holiday and so on, may be pre-programmed from the EPG3A's keyboard.

Tariff changes

As previously mentioned, tariff information is held in a fixed memory device known as an EEPROM. Each site where NITE is installed has been provided with a programmer in order to implement tariff changes detailed in NPDTE series work specifications.

History and further developments
NITE is a furtherance of the EPG1A and EPG2A projects which were to provide small exchanges – UAX's for example, previously dependent on wire broadcast (WB) links, from parent GSC's – with their own local tariff equipment. Replacement of STD tariff equipment has been discussed, but no decision has yet been made. Local call charging will remain under the control of the existing multi-phase pulse supply equipment at the larger exchanges.

Further References
Information may be found in TI's *E6 D1703, E6 R5813* (Maintenance) *A6 D3029* (Installation) and *A6 C1095* (Planning). A self-teaching style of course handbook has been produced by BTTC Stone.
(01-432 2045)

Under carpet cable for office Telecom systems

by **Alan George** BTNE/S32

Mention 'block wiring' to either installation or maintenance staff, and it conjures up a vision of distribution cabling terminated on boxes connection with masses of flexibility jumpers, non-existent records, floor trunking or conduit which never goes where it is needed, trailing cords and so on. Our staff will have to live with this legacy for many years to come. But at long last they can see some semblance of order in new internal cabling distribution (ICD) schemes.

New layouts are planned, on the basis of providing one pair of wires for every five square metres of floor space. A liberal provision on this scale means that BT has been able to adopt a system using Insulation Displacement Terminations (IDT), without the need for a cross-connection facility in riser shafts, for example. With new ICD schemes, building cable-pair records are a thing of the past because each pair appearance in a box connection now simply shows the building distribution frame (BDF) bar and pair reference. Floor distribution points are no longer randomly scattered around an office, as each one is planned to offer pair distribution throughout the building so that communication facilities have an equal probability of being easily connected to the ICD system. To achieve this, a simple and reliable practice was needed for connecting telephones to the ICD.

The need
Traditionally, new buildings are constructed with cast-in-situ concrete floor slabs, finished with a fine screed providing a smooth and level floor which easily accommodates trunking and conduits for telephone and electrical wiring. But the building industry – looking for means of reducing costs – developed a way of reducing the thickness of concrete floor slabs without impairing structural strength.

By 'polishing' green concrete floors, a smooth level surface can now be achieved which avoids the need to lay floor screeds. Both time and materials are saved and the height of buildings reduced, while retaining the same number of floors. 'Vertical' building costs are therefore also reduced. Using this method of construction means that there is no longer space to bury floor trunking in the concrete without impairing its strength. It is also extremely difficult to plan cable trunking in advance without knowing a tenant's requirements – a more common problem with widespread speculative developments. There was, therefore, a clear need to adopt some means of telephone wiring to overcome the problem of running cables to desk positions not close to skirting trunking – open plan office layouts for example. Furthermore, the Health and Safety at Work Act requires that trailing cables and cords which present a potential safety hazard to employees are avoided. Equally, the same problem arises with traditionally screeded floor finishes where

the developer is not prepared to install floor trunking and conduits.

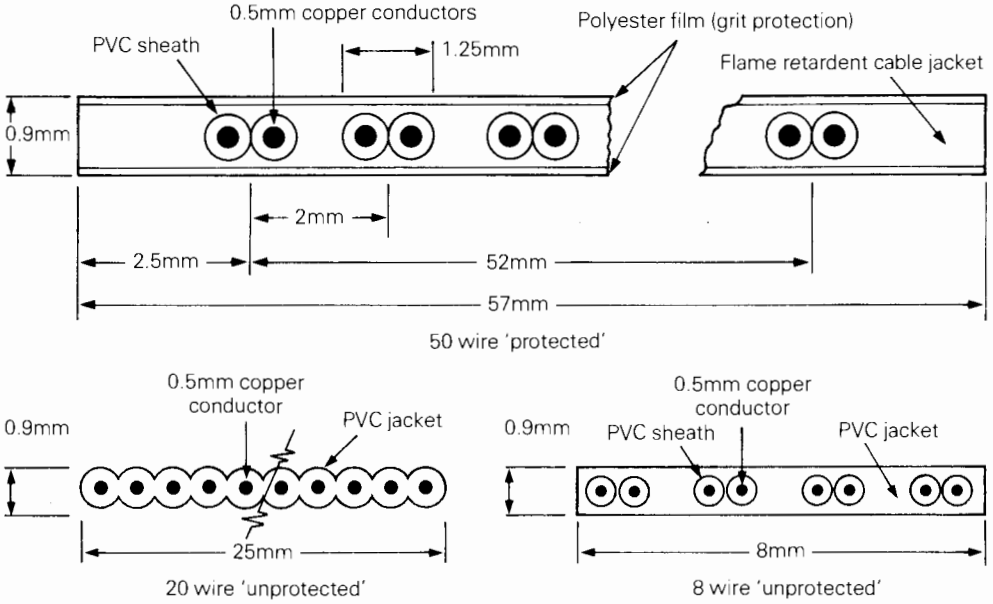
BTNE's solution

After being presented with particular cases of safety hazards by the Health and Safety Inspectorate, BTNE decided to try a system of flat, undercarpet cable developed by an American consortium of cable and telephone companies. A supply of cable was obtained and used to wire two floors of a new office building in Leeds for occupation by BTNE Service Division. A standard ICD scheme using flat cable was installed to serve an open-plan desk layout.

To test the worst and best conditions, one floor was cabled under 'stuck-down' body carpet, the other under removable squares. The cable is held in position on the floor by self-adhesive tape applied longitudinally over the cable. Two types of flat cable feature in the scheme – 50-wire specially protected against 'grit' penetration, together with 8- and 20-wire unprotected. Figure 1 gives the cross sectional details of the cables used in the trial. The flat cables interface with traditional round cables in skirting trunking using multiway male and female connectors. At the desk positions, similar terminations are used in specially constructed outlet boxes containing early versions of the line jack unit (LJU) which are used to plug in telephone apparatus. IDT techniques were adopted, special mass termination tools having been developed by the cable manufacturers for this purpose. The 50-wire flat cable was also used as a 'bus' which was intercepted at 'in-length tap-offs' to accommodate a liberal installation of parallel connected key and lamp units. The creation of in-length tap-offs was a difficult operation and one which is unlikely to be adopted by BT as a standard method.

Two fitters from Leeds Area were given on-site tuition on the installation techniques. Their enthusiasm for the system gave much encouragement to BTNEs design team. In-house use of the new cable gave opportunities to gain first-hand experience without risking adverse customer reaction, and to monitor closely the performance of the cable. Faults on the scheme were few, all but two resulting from mechanical damage caused by carpet fitters. Two major noise faults developed some time after installation. These were located to failure of the mechanical grit protection, causing subsequent chemical corrosion of the cable substrate. Laboratory analysis of the damaged cable identified penetration of the protective layer, allowing chemicals within the concrete floor to react with the cable, producing insulation failures. The analysis demonstrated a need for further protection against grit penetration which is effected by placing an additional layer of adhesive tape underneath the cable.

Figure 1. Cables used in the trial



The future

Inland HQ interest in BTNE's trial – and consideration of the difficulties and successes experienced – will lead to the adoption of under carpet cable as an alternative to standard floor wiring procedures. A cable specification has been drawn up and a number of cable manufacturers invited to submit samples for evaluation based on two sizes of cable, 6-wire and 50-wire, with the aim of launching the scheme shortly.

Essentials of the flat cable specification are:

- 0.4mm or 0.5mm conductor
- suitable for termination on Connectors 226, preferably on site
- must withstand point loading from office furniture and personnel
- resistant to grit penetration
- impervious to chemicals such as, concrete sealers, carpet adhesives, carpet cleaning fluids and solvents.

Initially the use of measured lengths of 50-pair cable already pre-terminated on Connectors 226 in a local workshop is one way of avoiding the need to purchase expensive mass termination tools for on-site use. Nevertheless, on-site termination is a future possibility once tool costs are reduced. Surplus cable which has to be 'lost' when using measured lengths, is achieved simply by folding the flat cable through a number of 90 degree turns.

Six-wire cable offers the dual facility of either underscrew termination or IDC.

Laying under carpet squares is strongly recommended. If the cable is laid under body carpet, additions to the scheme and replacement of faulty lengths will prove both difficult and time consuming.

Additional mechanical protection against grit

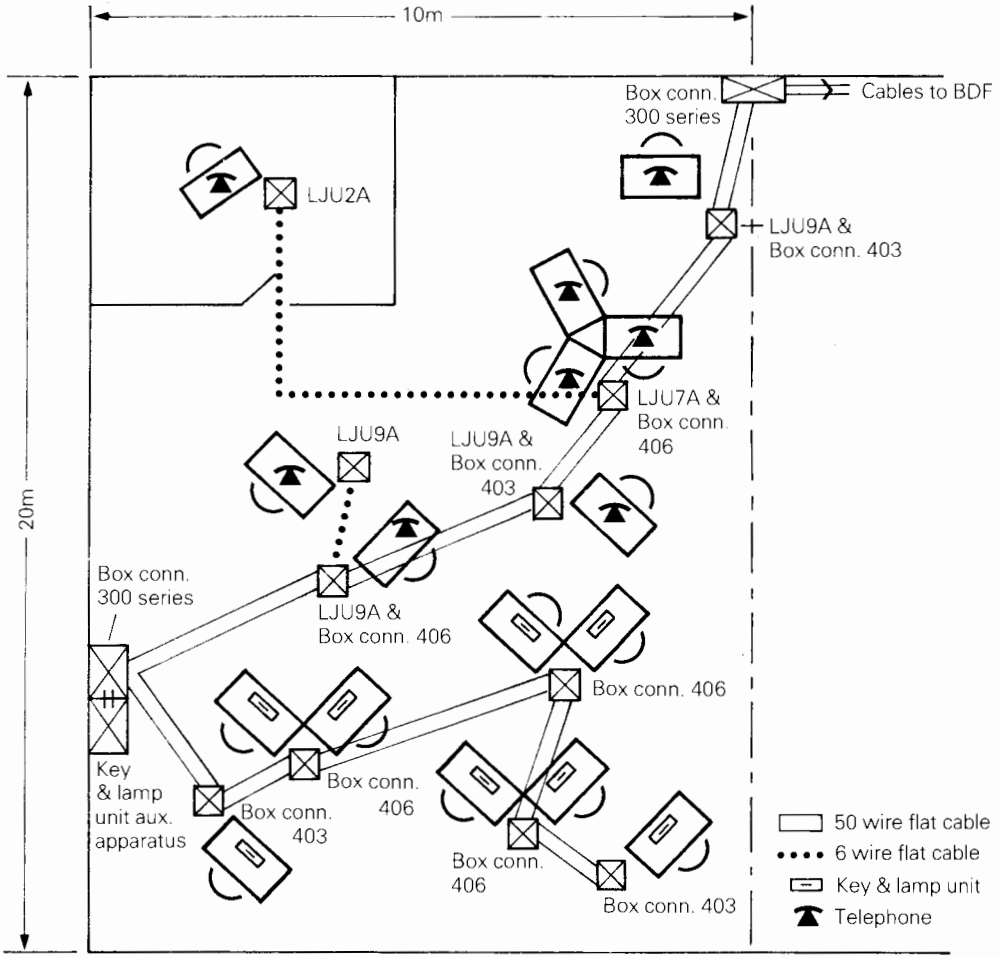


Figure 2. Layout of the future

ITEM	DESCRIPTION	TYPICAL USE
Line Jack Unit No. 7A	Six line jacks wired to a Connector No. 226	Interface flat cable with plug ended telephone cords
Line Jack Unit No. 8A	12 line jacks wired to a Connector No. 226	
Boxes Connection No. 403, 406, 409	Three, six or nine Connectors No. 226 parallel wired	In length intercepts on flat cable and interface between round and flat cables
Box Connection No. 426	Two separate sets of three Connectors No. 226, each parallel wired	
Line Jack Unit No. 9A	One Connector No. 226 and single line jack which can be wired to any terminals of the Connector	Individual tap-off from flat cable at a telephone position

penetration will be offered by laying PVC adhesive tape both under and over the cable.

Interface with telephone cords and ICD schemes will be achieved using a number of items currently under development.

A typical layout using the proposed new range of flat cable and connecting devices is shown in Figure 2.

There can be no doubt that flat undercarpet cable will be a welcome addition to the range of products needed to meet customer requirements – being aesthetically acceptable in today's modern offices and, possibly, the home. It fulfils the requirements of the Health and Safety at Work Act, offers scope for imaginative use and reduces installation labour costs resulting from easy lay and fast termination methods. Couple these advantages with the prospect of flat (low profile) coaxial cable, and the way ahead is clear for a totally unobtrusive cable system. Because the initial cost of the cable will be high – until large volume production is assured – consideration is being given to charging a premium to those customers who specify its use either by design or because they will not accept a cheaper standard alternative. From a maintenance viewpoint there is every indication that the new cable will prove reliable – even in the harsh environment sandwiched between floor coverings and structural concrete. We look forward to its successful introduction.
(0532 467607)

Operations and maintenance centres (OMC) – a key element in the introduction of System X

by **Len Strickland** LES 6.2.2

Current System X penetration

System X exchanges – now called Telecomms Exchanges Digital (TXD) – are already in service in the UK. There are two medium locals (TXD 6) at Woodbridge, Suffolk, and Arrington, near Cambridge, and a trunk switching unit (TXD 13) in Cambridge itself. In London there is a tandem switching unit (TXD 12) at Baynard House. There soon will be a medium local exchange at Hale, and a tandem unit at Lancaster House, both in Liverpool Area.

There are also two OMC's in service – at Cambridge and in Baynard House. A third OMC will be brought into service in Liverpool to coincide with the opening of the Lancaster House TXD 12. In the next five years it is planned to introduce about 60 TXD trunk units, 300 TXD local units, and 800 remote concentrator units. An essential part of the TXD programme will be to assess each Area's needs for OMCs, and to provide them accordingly.

What is the OMC's purpose?

OMCs have two main purposes in the network

- exchange maintenance
- administration

as explained here –

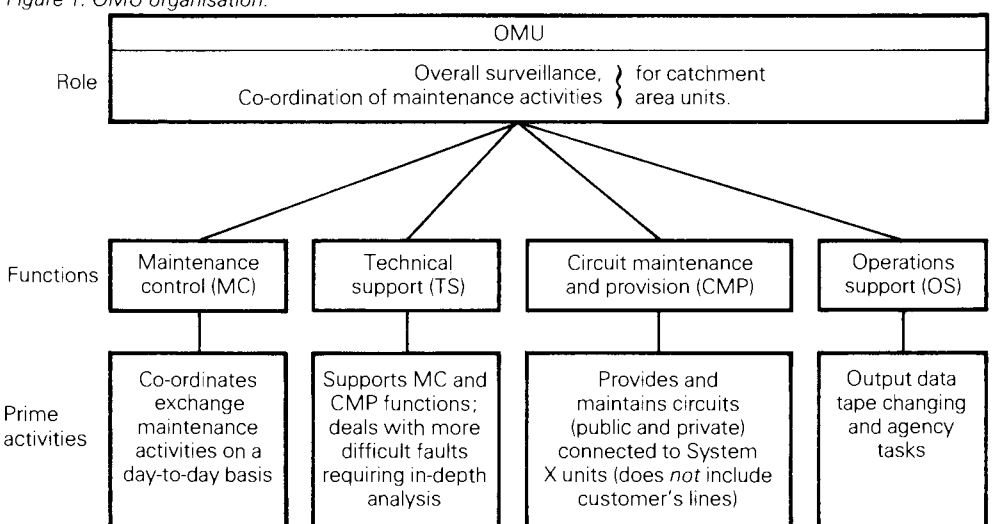
Exchange maintenance

Exchange maintenance, and other associated activities within a designated OMC catchment area, are controlled from a staffed part of the OMC called the operations and maintenance unit (OMU). The OMU is usually located in an exchange building – although not absolutely necessary – and the accommodation is planned to be a pleasant working environment. There are many activities performed at the OMU, as can be seen from the organisation diagram – Fig. 1.

Figure 1 shows that the OMU has the role of 'overall surveillance' and 'co-ordination of maintenance activities'. But it should be noted that this excludes customer's line maintenance since this is still performed at the repair service control (RSC). In this context, surveillance means that if a fault occurs on any of the exchanges within the OMC catchment area, then the maintenance control officer (MCO) will know about it. He will know by two methods.

An alarm message – relayed to an alarm-receiving visual display terminal known as an alarm display and control unit (ADCU). The ADCU display will inform him of the identity of the exchange concerned and will give him a simple indication of the problem. For example, a processor fault. The ADCU gives the alarm →

Figure 1. OMU organisation.



reports as numerical references in the range 1 to 15. At the TXD itself, there are 15 alarm lamps which have a one-for-one correspondence with these numbers, so the ADCU at the OMU gives a replica for every exchange within the area, using a single display.

There will also be a detailed fault report which is assembled by the maintenance control subsystem (MCS) of the TXD concerned and directed, or streamed, by the OMC processor to the MCO. The MCS report will be received on a visual display terminal (VDT) on the MCO's work position in the OMU. This will have added information on the previous fault history. This MCS fault report will also be automatically stored on disk on a current fault file and the MCO can access this file from his VDT to add comments. For instance, he may record that this fault has been assigned to a particular engineer to deal with.

This brings in the co-ordination of the maintenance activities aspect, since if the TXD concerned is an unstaffed unit, then the MCO will need to contact an engineer to go to the exchange. When the engineer goes to site he will be able to perform the necessary procedures from a local control point (LCP) terminal and to clear the fault – possibly by changing a faulty slide-in unit. He will also be able to directly interrogate files at the OMC from the LCP since there will be a work list called the technicians work program allocated to him. This is useful, since he may well be responsible for a number of TXD exchanges – one of which could have become faulty while he was travelling to his location. It serves also to put faults in priority order for attention.

The maintenance control function (fig 1) has been described, but there are other functions in the OMU.

Circuit maintenance and provision (CMP) is perhaps fairly straight-forward, but the others may require a little more explanation. Technical support (TS) – this is an activity which becomes necessary with exchanges based on the technology used with TXD. Elusive faults – for example, intermittent or incipient problems – will occasionally occur.

The technical support engineer would be able to review fault histories using a 'browse' facility, and do the correlation work necessary to track down the problem. He would do this without the distraction of having to respond to new alarms, leaving these to the MCO.

Man-machine language

Whenever an exchange engineer wants either to input commands from his terminal to the OMC processor, or to a TXD, he has to use System X man-machine language (MML). To obtain commands necessary for a particular task, he needs to consult documentation known as the operations and maintenance manual (O&MM). Initially, the MML will seem strange and often complex; but as experience is gained, engineers become very proficient in this field, and may need to refer to the O&MM only for the little-used commands. Operations support (OS) at the OMU is necessary to aid other OMC terminal users outside of the OMU itself; for example, to do agency tasks under terminal failure conditions at the remote end. The agency tasks may be better understood by considering the administrative need for the OMC.

Administration

With TXD, the operational and subscriber's facilities and the network configurations are determined by software and data loaded onto the TXD. To interrogate the data, or to change it (temporary out of service a line, for example) requires only to input commands from a terminal having access to the exchange and with the user having the necessary access rights. Many terminal users come into this category, some engineering and some non-engineering.

The OMC acts like an exchange for all terminals provided remotely from the TXD (this even includes exchange maintenance terminals at remote concentrator units (RCU).

Remote terminal users outside of the OMU are classified as non-OMU, and seven of these have so far been identified. These represent the administration services provided by a Telecom area office —

- sales office
- customer services
- Auto-manual centre (AMC)
- territorial accounts group (TAG)
- repair service control (RSC)
- trunking and grading duty
- installation control office

An example of a task performed at the terminal would be a 'one-off' meter reading. A

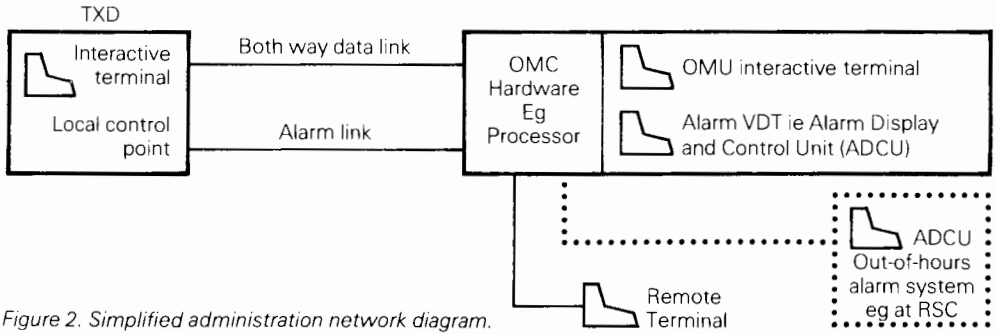


Figure 2. Simplified administration network diagram.

TAG officer with a terminal could do this, but if the engineer at the OMU (OS function) does it, it would be an 'agency' task on behalf of TAG.

The introduction of System X remote administration facilities, using VDTs, to users such as sales office and TAG has identified the need to develop a man-machine language which is more suited to their needs that the engineering-oriented language currently provided on System X.

Thus an MML 'translator' has been developed which provides such user-friendly facilities as 'menu mode' working, and simplified transactions. These will be incorporated into all future OMCs.

How OMCs fit into the network

Figure 2 shows a simplified administration network diagram. This is the network which is used exclusively for BT needs, and carries no public switched telephone traffic.

When a TXD exchange is to be connected to an OMC, circuits must be provided as follows –

- a bothway data link to enable fault and other data to be passed to the OMC, and to provide a path for requests from OMC terminal users to interrogate data stored at the TXD, or to change it
- a separate link for alarm messages from the TXD overlay to the alarm reception equipment at the OMC. In the event of OMC processor failure this equipment would still be operative.

As each TXD is brought into service in the area, it will be connected to the OMC.

Figure 2 also shows an ADCU at a repair service control (RSC). The RSC could be a nominated out-of-hours surveillance point for exchange alarms if the OMU itself was not a 24-hour staffed centre.

Future OMC developments

The OMCs which are in service at Baynard House and Cambridge, as well as that to be shortly introduced into service at Lancaster House, Liverpool, are a form of OMC known as OMC1. The processor and most of the other rack mounted hardware for this OMC is TEP 1H practice – the TXD standard. A switching processor is also used – the pre-processor utility (PPU). Two more of this type of OMC are scheduled, at Coventry and Leeds.

However, it has been recognised that a switching processor is not ideally suited to the tasks required of an OMC. Also, advances in technology have out-dated the original design, so a successor to OMC1 is in the pipeline, known as OMC2. It will have some major differences, and will not be available for two or three years. In the meantime, a small-scale development known as the 'Basic OMC' is expected to bridge the gap. Basic OMC uses micro-computer techniques, such as local area network (LAN) or multi-user multi-processor (MUMP) methods.

One thing is certain. That is, that OMCs will be recognised as a valuable part of the System X programme, and experience gained on the present generation will be essential input to future OMCs.

(01-432 1344)

TXE4: Present performance and future targets

by **Peter Jones** LES4.2.2

TXE4 is now one of the major exchange systems in British Telecom. At present there are 245 TXE4(RD)s in service with another 105 to be brought into service by 1985. TXE4(RD) has been joined by an improved design know as TXE4A, of which five are now in service with another 229 to follow by 1989 (fig 1). At the moment service is provided for about 2 million customers but eventually TXE4 will have a capacity of nearly 8 million connections (fig 2). ***(Maintenance News 10 described TXE4, and MN16 described TXE4A).***

PRESENT PERFORMANCE TXE4(RD)

The present national performance of TXE4(RD) can be judged from three main information sources –

- A51 Results (Line 28: Customer reported faults) see fig 3
- MAC test sequence 1 (own exchange calls) — fig 4 *(MACs are Measurement and Analysis Centres – see MN11)*
- Major Service Failures (MSFs) see fig 5.

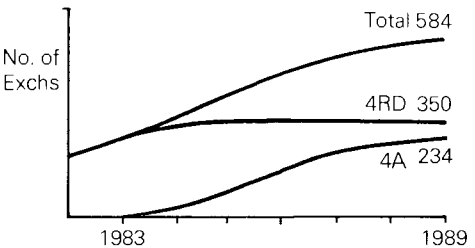
□ A51:

The customer reported faults are higher than we might expect for an electronic common control system, especially with a second attempt facility. This is an area currently under investigation by BTHQ.

□ MAC:

The results for MAC Sequence 1 (own exchange calls) show that TXE4(RD) performs very well; at the time of writing it has the best MAC figure of all systems. The good MAC figures highlight the anomaly of high customer reported faults as opposed to good measured performance.

Fig 1



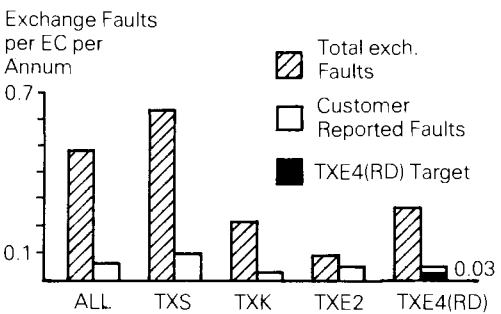


Fig 3

□ MSFs:

The MSF performance of TXE4(RD) is very poor. The current mean-time-between-failures (MTBF) is only 14 months. A lot of work has been carried out in this field and some twenty-seven design deficiencies (DDs) have been identified. However, it is encouraging to know that no new DDs have been discovered since

Fig 2

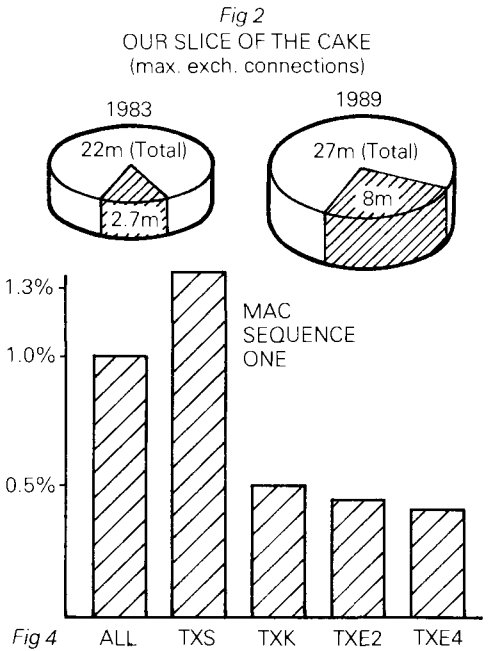


Fig 4

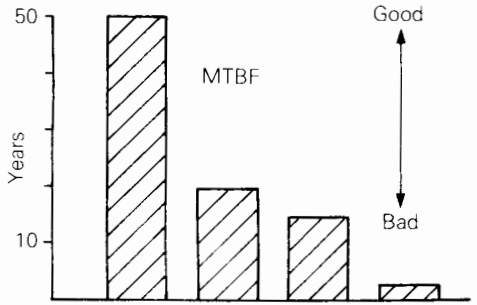


Fig 5

August 1981, so it looks as though we have identified all the causes of MSFs due to DDs. Works specifications have been issued, or are in an advanced state of development, that overcome all but one of the DDs still under investigation. The implementation of these works specifications is already starting to improve the MTBF, but even when they have all been implemented TXE4(RD) will still have a very poor performance when compared with other systems. The reason for this is the number of MSFs caused by Working Parties. At present they account for over half of all MSFs, which is equal to all the MSFs in TXE2 and TXK1 put together. Most of these failures were caused by carelessness, and responsibility lies equally with BT maintenance, BT construction and contractor's staff.

TXE4A

TXE4As are performing well and all the indications are that they will provide a very good service indeed. However, their contribution to the national targets will not be significant until about 1985.

Future Targets

In the future it will not be possible to show the national performance of TXE4(RD) and TXE4A separately due to the method of data collection. The future national targets for TXE4(RD,4A) are –

- Customer reported faults: 0.03 per exchange connection (EC) per Annum by mid 1984
- MAC own exchange call failure due to plant defects: 0.2% by mid 1983
- MTBF: At least 5 years by mid 1984.

There are many things in the pipeline which should assist in achieving these targets, including:

- Use of Network Analyser PATE4 (see *MN21*) and other maintenance aids
- Improvements to routiners (outgoing junction (OGJ) and Link)
- Works specifications to improve design weaknesses

However, there is action we can all take in order to meet our targets –

- A51 – If a customer reports a fault that is subsequently proved to be in the exchange, answer the question – "Why didn't we find the fault first?"
- MAC – Ensure that routiners are used effectively by following up all the faults shown in the printout, including a check on busied circuits. It is well worthwhile having a tick sheet to highlight those circuits that regularly appear in the printout.
- MSF – The majority of MSFs are caused by working parties, mostly as a result of careless action. Extra care must be taken when working on or near sensitive areas of the exchange and the rear of racks, if this disappointing aspect of TXE4 is to be improved.

Much work has been carried out at BTHQ, Regions and Areas to improve performance, and this has paid dividends. But we have now reached the point where further improvements to TXE4 depend substantially on the effective use of all the available maintenance aids. With carefully applied maintenance techniques, TXE4 can out-perform all the other existing systems. (01-432 2457)

The Ambassador Electronic Switching System (ESS)

by **John Bright** RA152

The Ambassador electronic switching system (ESS) is a microprocessor controlled operator-less switching system designed to cater for the smaller house exchange system (HES) and extension plan markets.

Ambassador ESS was trialled in Newcastle-upon-Tyne and Southampton telephone areas during the Summer of 1982, and will soon be available nationally.

Development

The Ambassador ESS was known during its development as the electronic plan set (EPS) and formed part of the range of modern equipment developed during recent years to supersede the 700-type instruments.

This range includes the basic Ambassador telephone, Accord loud speaking telephone, Herald call connect system and various add-on units all of which have the same profile to give a matching appearance and distinctive house style.

Reliability and ease of installation were prime objectives in the design of the EPS and resulted in the adoption of a central unit 'star' configuration connected to extension telephones by means of four-wire cabling. Thus the traditional multi-wire concept – which is time consuming and costly both in installation and maintenance – was avoided.

The central control unit (CCU) was designed to be wall-mounted and contain its own power unit and line terminations for neatness and ease of installation. The cabling to extensions was kept straightforward and consisted of a speech pair and data pair direct from the CCU to each extension. This enabled extensions to be added, recovered or shifted with the minimum alteration to existing wiring.

Three sizes of EPS were developed, these were the 1+3 and 2+4 systems and the 5+10 growth system.

The EPS 1+3 and EPS 2+4 systems became the Ambassador ESS (1+3 and 2+4). The EPS 5+10 has since become known as the Senator call connect system and is now also undergoing national launch. This uses the same extension telephones and adaptor units as Ambassador ESS but has slightly different operating procedures and is aimed at the key and lamp and larger HES markets.

Senator was designed for modular growth. The central unit contains slide-in circuit boards and comes equipped for up to five exchange lines and six extensions. Extension capacity may be increased to a maximum of ten by the addition of extension interface circuit boards.

ESS Central Control Unit (CCU)

There are two sizes of CCU, the 1+3 CCU being 300mm long by 190mm wide by 75mm deep, and the 2+4 CCU slightly larger at 480mm long.

The CCU comprises a power unit, line and extension terminations and a single circuit board containing a relay speech path switching matrix with microprocessor control circuitry.

The CCU microprocessor is the brain of the system and constantly scans the extension data and exchange line interface circuits. Whenever there is a change in condition, it refers to its program and responds accordingly.

For example, when an incoming ringing signal is detected by the exchange line interface circuit, the microprocessor detects the change in condition and is instructed by the program to signal the extension telephones. Data signals are sent to the extension telephone microprocessors which decode them to light the calling LED indicators and sound the buzzers.

When an extension answers an incoming call, the telephone microprocessor signals the CCU microprocessor which then sets up the switching matrix between exchange and extension speech pairs to complete the call path. All signalling between the CCU and extension telephones (except under mains fail conditions) is carried out over the data pairs.

Extension Telephones

Ambassador ESS extension telephones are similar in appearance to the basic Ambassador telephone, they are slightly wider and have an additional column of buttons and LED indicators to the right hand side of the keypad. The additional column of buttons and LED indicators form part of the plan module which communicates with the CCU over extension

cabling data pairs. The top two buttons of the plan module are for accessing exchange line(s), the middle three for direct named press-button intercom and the bottom two for divert, hold and exchange line ring programming facilities.

The keypad functions as a normal keypad and is available in two signalling versions; the self-contained loop-disconnect pulsing version is for Ambassador ESS systems working to Strowger pulsing exchanges or PABXs, and the MF4 signalling version for working to exchange or PABXs with multi-frequency (MF) signalling capability.

Ten address, X-Press Callmaker versions will soon be available as an added attraction.

Ambassador ESS extension telephones have electronic 'buzzers' instead of bells to provide audible signalling. These are quite adequate for the normal office environment but may be replaced by a magneto bell and bell adaptor if required.

Facilities

Although the Ambassador ESS is a small switching system it offers many of the facilities of larger systems, including:-

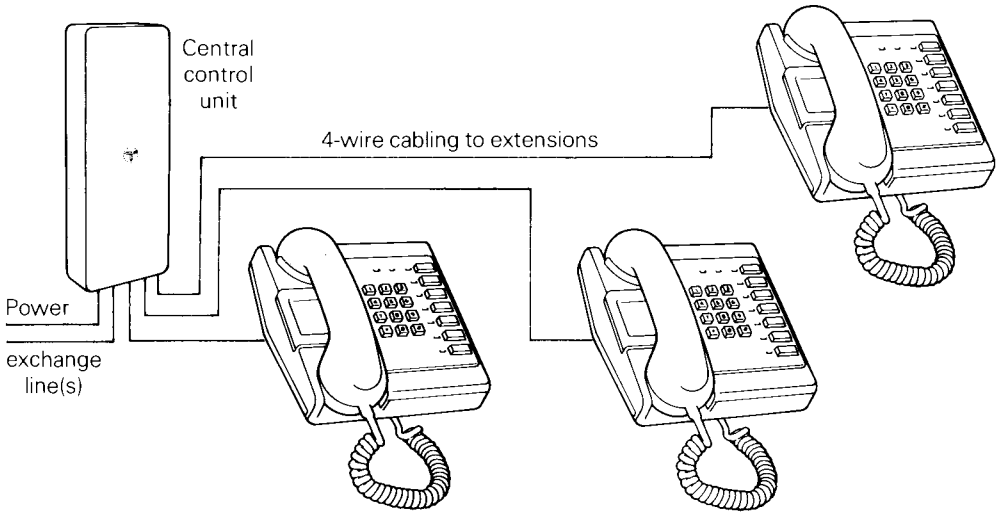
- press button access to exchange lines for outgoing and incoming service.
- direct named-press button intercom to other ESS extensions.
- Exchange line hold for secret enquiry calls.
- Diversion of intercom calls to another ESS extension.
- Programmable ringing on exchange line calls (bell off facility).

The facilities are all easy to use and programming for exchange line ringing and intercom call diversion is carried out by the customer using the extension telephone plan-module buttons.

A series of adaptors have been developed to further expand the facilties of ESS and these will soon be generally available. They include:

- Extension Bell Adaptor, to provide magneto bells at an ESS extension instead of the internal electronic buzzer.
- External Extension Adaptor, to permit a standard 2-wire loop-disconnect pulsing telephone to replace an ESS telephone at an extension.
- Inter-PBX Extension Adaptor, to replace an ESS extension and provide inter PBX tie-line facilities and remote answering facilities.

The provision of adaptors is documented in the Ambassador ESS handbook.



Maintenance

The design of the central unit is such that only fuses can be changed on site. Maintenance of the system is therefore restricted to checking cable and wire terminations, changing fuses and replacing standard items within the terminal instruments. Beyond this the requirement is for complete unit/terminal changeout.

The Ambassador ESS handbook (Customer Apparatus Guide Notes 0012) contains a detailed system description and the maintenance section includes a logic faulting chart to assist in identifying faulty units.

As with many newly developed items of customers apparatus, service problems have been encountered and these are being corrected. Full details of those problems identified to date and their solutions are published in the Ambassador ESS and Senator CCS Newsflash series issued by BTHQ/RA 152. (01-423 2349)

New housings for Public Call Offices (PCO)

by **Dave Popham** ID/CE4.2.2
and **Maurice Bradley** BTL/S4.1.3

To meet growing pressure from developers and local authorities, BTL, supported by BTHQ, have developed a range of PCO housings to replace our previous sole offering – the Kiosk No 8. They are called the 'Croydon' range to acknowledge the contribution of BTL South Area staff who translated the sketches and ideas into hardware (and added some of their own).

The range comprises a kiosk, an internal booth for concourses and like situations, and an external booth for quiet environments. There is also a wall-mounted version of the internal booth. These housings all have a family resemblance and are jointly recognisable as 'British Telecom' rather than 'Post Office' property. There is no anti-vandal model in the range, since the requirements for such a housing are not compatible with a 'civilised' design. So it was decided that the 'Oakham' booth would continue to fulfil that need.

The Croydon range was designed by engineers with long experience of PCO installation and maintenance. Although essentially practical, general reaction to the appearance has been very favourable.

The basic structural materials are hollow rectangular metal sections (HRMS) and sheet steel – chosen because they are easy to obtain, cheap, rugged and can be fabricated in large or small quantities in various workshops – including our own – throughout the country. A paint finish was chosen because it can be maintained in good condition by our own staff without requiring specialist treatment. Anti-graffiti paint is an option.

The main members of the Croydon family all use the same back module. This is logical since all perform the same functions – mounting the same equipment, and leading-in and terminating electrical, telephone and earth cabling and wiring.

The module consists of two 120×60mm HRMS posts, connected by a 3mm steel sheet back panel. Welded to the back panel are horizontal sections of 'Unistrut' to which the equipment fixings can be bolted. Intermediate fixings are obtained using short lengths of Unistrut as movable ladder bars between the primary sections. In this way fixings may be made at any point for any type of equipment and they can be easily repositioned at any time in the future.

A plastic-faced wall board hides the Unistrut in the upper part of the module and can be used itself for the screwed fixings of lighter items.

The lower section of the module has a services termination chamber with removable covers to house electrical switchgear and earth terminations. The whole base area of the chamber is available for UG cable lead-in. All cabling is completely concealed. Alternative high-level cable entry can be provided.

The corner post bases contain welded-in threaded plates which connect to a base frame in the concrete foundation, making it very strong and rigid for a free-standing booth. Alternatively, 'feet' may be used where only shallow depth exists or – if wall support is available – the module can be bolted to a floor and tied back to the wall. The kiosk may be bolted to a concreted-in base frame or to a paved surface. Precast, domed, non-slip slabs can be provided to give good drainage and this avoids the central wear, which creates a puddle for users to stand in on wet days. Alternatively, surrounding paving can be continued straight through.

Cheery glow

Booths may be 'suited' by sharing adjacent support posts and side screens, but this is not so with kiosks because of the large stock of alternative components needed. Kiosks and booths can be installed back to back. The kiosk may have side or front door opening with left or right hinging.

All housings have steel ceilings with a central opal acrylic lighting panel. This hinges down to allow standard (No 12) fluorescent lighting unit tubes to be changed without using steps. The installation is double insulated.

Above the ceiling is an acrylic and aluminium dome, which has either opaque black characters for a payphone or translucent green characters for a cardphone. The dome is internally lit from the sides of the lighting fittings and at night gives a warm cheery yellow glow to advertise the presence of a payphone.

The dome also houses the (standard) door closer, its spindle projecting down through the ceiling. New geometry for the closer arms makes for easier opening and prevents doors from being torn off their hinges in high winds.

Restraining straps across the standard (No 2) hinges are not necessary.

In the kiosk, six identical panes of glass are set in rubber channel and held by angle iron glazing beads pop-rivetted into place. The rivets are drilled out when necessary. The glass in all housings is bronze tinted, 6mm armoured. In the booths, glass is set in rubber and stainless steel channel, which is removed for re-glazing.

Standard wallboard layout

In the present Croydon design a single, full-width, polycarbonate notice cover is provided at the top of the wallboard, retained by heavy steel bars top and bottom. The sides are unframed but protected from prising or levering by being set back some 75mm between the steel corner posts, which also protect the sides of the wallboard. The wallboard is the same width as that in the K8 and K6. So, not only are the equipment layouts consistent in all the housings, but new-style notice frames being developed for use in existing kiosks can be used in Croydon housings.

Wind swept

Another feature of the kiosk is the 100mm space left below each fixed side and the door, so that rubbish can blow out in the wind. This reduces the level of acoustic protection for the user, but the gain in cleanliness and ventilation is considered to outweigh the increase in noise level. As there will be less difference between the protection offered by a kiosk and that by a booth, we may well be able to use a high proportion of the cheaper booths. Booths attract less vandalism than kiosks.

The colour scheme adopted for the range is: outside back panel, rear corner posts and dome in yellow; all other framing and wallboard in black.

The slim framing and large areas of glass give a light and airy appearance and the high level of illumination (32 watts) ensures good visibility of occupants to discourage fouling or other abuses.

Initially about 50 kiosks have been ordered by BTL for trial, and 25 for BTHQ. Seven internal booths have been installed at Bristol Temple Meads station, as a trial for British Rail. If accepted by BR the booth will become standard for use on BR installations throughout the country. Milton Keynes Development Corporation is currently considering the wall-mounted booth for the first indoor PCOs in the covered shopping area. They have also shown interest in replacing all Milton Keynes kiosks with Croydon housings, but this has been resisted on grounds of cost and availability.

The first kiosks have been erected in Leicester Square and Oxford Street, in London and it is BTL's intention to use them on other prominent sites, gradually extending their use as opportunity offers.

(01-432 2772) Dave Popham
(01-735 3713) Maurice Bradley

A suite of Croydon internal booths at Temple Meads BR station

The Croydon kiosk illuminated

Lightning protection of modern equipment

by **John Haggart** T8.2.1

In 1980, lightning activity resulted in the isolation of two TXE4 exchanges and highlighted the need to review lightning protection policy.

Lightning can cause high voltage surges in the network as a result of direct strikes to cables, or from induced surges due to strikes adjacent to overhead and underground telecommunications plant. The frequency of occurrence and the severity of these conditions varies according to the nature of the terrain, the screening effect of buildings, and the type of plant construction. Modern electronic equipment is more susceptible to damage by lightning than the robust electro-mechanical equipment previously used for switching purposes.

Information on the incidence of damage to both protected and unprotected exchanges leads to the conclusion that, when fitted, protection equipment *is* effective in preventing damage. Conversely, there is a significant risk of serious damage to equipment in vulnerable areas if it is unprotected. Current instructions on the provision of lightning protection are not mandatory and they cannot contain advice applicable to every circumstance. The instructions do, however, define a standard of protection which constitutes an economic mean between the cost of fitting protection and the cost of repairing damage, including out-of-service time and maintenance, if protection has been omitted. In a number of cases investigated, the cost of fitting protection as given in the instruction, would have been much less than the cost of repair work during a single season.

The TI *A2 E0601,* relating to the protection of digital, electronic and crossbar exchanges – and also PABXs – recognises the importance of protecting both public exchanges and customers' terminal equipment. In the case of privately-owned-and-maintained PABXs it is for the customer, acting on the advice of his supplier, to decide on the protection required. But clearly there is no objection to the customer being advised of BT protection policy.

Exchange protection

In considering the vulnerability of a line to lightning surges, the main factor to be taken into account is the level of screening afforded by other buildings and services. In city centres, buildings and plant in the ground such as metal pipes and armoured cables, together with additional screening that may be provided by high conductivity soil conditions, will reduce surges to a low level. Where such protective screening doesn't exist, then surges severe enough to damage equipment can occur – even on wholly underground cables.

When should protection be fitted?

The only lines on which MDF protection is not necessary are those which are wholly underground, or have no more than one span of aerial cable or dropwiring, and which pass through and terminate wholly in built-up areas. Such areas typically include city centres, heavily built-up commercial and industrial districts and urban high-density residential areas. Protection is needed on *all* other lines – including those which pass through rural or low-density residential districts, even though they may terminate in a built-up area.

In addition, lines with more than one overhead span, including dropwiring, need protection at the MDF even though 'pole-top' protection as given in *TI A2E 0504.*

How should protection be fitted?

Termination blocks capable of taking lightning protectors should be provided on all cables at new exchanges. But the extent to which protectors actually need to be fitted will depend upon the environmental factors already mentioned. Where more than 75% of the lines in an exchange need protection, every line in the exchange should be protected. Where conditions are such that less than 75% of the lines in an exchange require protection, the exchange area should be sub-divided into smaller areas – typically an area served by a primary cross-connection point – to determine which lines require protection. Protector mountings should preferably be provided on the line-side of the MDF, as this facilitates identification of lines needing protection. But whether or not this can be achieved at new

exchanges will depend on whether or not the MDF is to re-terminated.

In the case of exchanges which are at present unprotected, the cost of providing protection and the degree of disturbance their provision is likely to entail will depend on the type of MDF termination in use. A range of hardware is available for retrospective fitting of protector mountings, see *A2E 0601* for details.

Protection of customers' terminal equipment – call connect systems and PABX's

Customers' modern call connect systems – particularly electronic equipment using stored program control – have proved vulnerable to voltage surges from lightning and other causes. Equipments in this category include Monarch, Herald, Ensign, Regent, Viceroy, Senator and others.

Reports of damage to such installations have shown that the recommended protection had not in all cases been provided. The susceptibility of this type of equipment to damage by relatively small voltage surges is causing concern and is the subject of detailed investigation within IDHQ. Meanwhile it is important that existing lightning protection recommendations are adhered to.

When should protection be fitted?

The protection of customer's electronic call connect systems should follow the same principles – previously outlined – for the protection of exchange equipment (TI *A2E 0601*). The following summary as to where protection should be fitted may prove a useful aid in this respect. Protection should be provided where one or more of the following apply:

- the customer, or the serving exchange, is sited in an area which is not built-up
- the external cable line passes through an area which is not continuously built-up
- there is more than one overhead span in the customer's line
- the serving exchange has protectors provided on the cable concerned
- there is any record of past lightning damage.

Protection should normally be fitted at the first cable termination point in the customer's premises. If this is not convenient – as may typically occur in a multi-tenanted building – it may be provided at other terminating points in the building.

How can protection be fitted?

At large installations protection can be provided on the building distribution frame (BDF) by means of Strips Connection which are of the insulation displacement type and into which Protector Mountings, incorporating 3-pin gas discharge tubes (GDTs), can be plugged. At smaller installations the Box Connection 300 series, in which the above items can be mounted, should be used. For further details see TIs *C3F 0051* and *C3F 0052*.

The three-terminal GDTs used are self-restoring devices, the end terminals being connected across the line and the centre terminal to earth. To ensure efficient operation of these devices it is essential that they are connected to an earth of less than twenty ohms resistance. Achieving this low value of earth resistance is not usually a problem at exchanges but it may prove more difficult at customers' premises.

You can help

In the competitive environment in which BT is now operating, it is essential we maintain our position as a supplier of reliable terminal apparatus. Experience has shown that maintenance costs – and service interruptions – can be significantly reduced by proper application of lightning protection practices. To assist IDHQ in assessing the effectiveness of current protection policy, we would welcome information from the field concerning equipment failures attributable to lightning. (01-739 3464 Ext 433)

KILOSTREAM–Fault handling procedures

by **John McKenna** SSE1.3.2

In this article, readers are introduced to one of our new services, and informed about what is being done to ensure that our customers remain satisfied with BTs maintenance operations.

The national private circuit digital network (NPCDN) is a pre-provided network based on digital junction and main network plant. As its name implies, NPCDN is dedicated to the provision of private circuits.

When these derived private circuits present a digital interface to the customer – by means of a customer-located data circuit terminating equipment – the signals on the circuit are truly digital in nature throughout the network, customer to customer. These digital circuits are known as the Kilostream service and allow the synchronous transmission of digital data at either 2.4, 4.8, 9.6, 48, or 64kbit/s. NPCDN can also be used to provide normal 2-wire or 4-wire presented analogue private circuits. Kilostream is one of the range of X-Stream digital services which also includes Megastream, Satstream, and Packet Switchstream.

The facilities offered by the X-Stream range of services are intended to enable BT to compete successfully with the facilities offered by rival telecommunications carriers – such as Mercury.

In this new communications environment, it is essential that the quality of customer service provided by BT is at least equal to that of the competition, both during and outside normal working hours. Recognising this, arrangements have been made for the London X-Stream Service Centre (XSC) to be staffed to accept customer fault reports 24 hours a day, 7 days a week, all year round. Outside normal working hours, customer fault reports directed to the Manchester XSC willl be automatically re-routed to the London XSC.

Handling procedures

Outlined below are the fault handling procedures at XSCs, NPCDN cross-connect sites (CCS), serving exchanges (SE), and by field maintenance staff dealing with fault reports on Kilostream and speechband private circuits derived from the NPCDN.

The fault handling arrangements are based on two XSCs, London's Baynard House and Manchester's Irwell House. The function of an XSC is to act as the maintenance control and customer fault reporting point for those NPCDN-derived private circuits which are 'A-ended' within that XSCs territorial area of responsibility. These are –

- London XSC – BTL, BTSE, BTSW, BTEast and BTWM
- Manchester XSC – BTM, BTNW, BTNE and BTScotland.

Customers wishing to report a fault may contact the appropriate XSC either by:

- dialling the national number for the London or Manchester XSC (01- or 061-236 3371)
- asking the telephone operator for 'Freefone 3371'
- dialling telex 893927. All fault reports by telex are received at the London XSC, and will be passed to the Manchester XSC when appropriate.

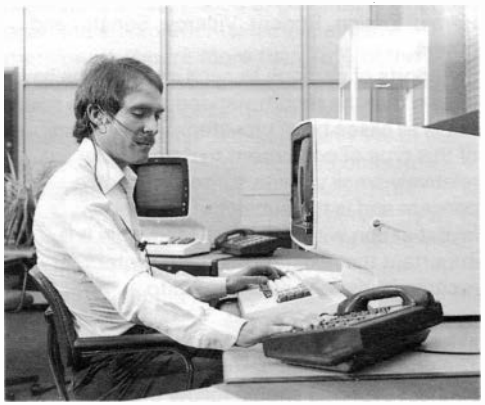
On receipt of a fault report the aim is for the XSC to remotely access the circuit in question at the appropriate CCS and – under remote control – carry out all necessary diagnostic tests. Faults are then handed out to the appropriate point for clearance.

Since all items required to totally implement this strategy will not be available at the opening date of the network, the strategy will be phased-in over about three years, as illustrated by figures 1 and 2. The principal factors of each phase are –

☐***Phase 1***

- Circuit records entered on the Computer Assisted Maintenance for Special Services (CAMSS) at XSCs. (Fault handling and

Manchester's XSC



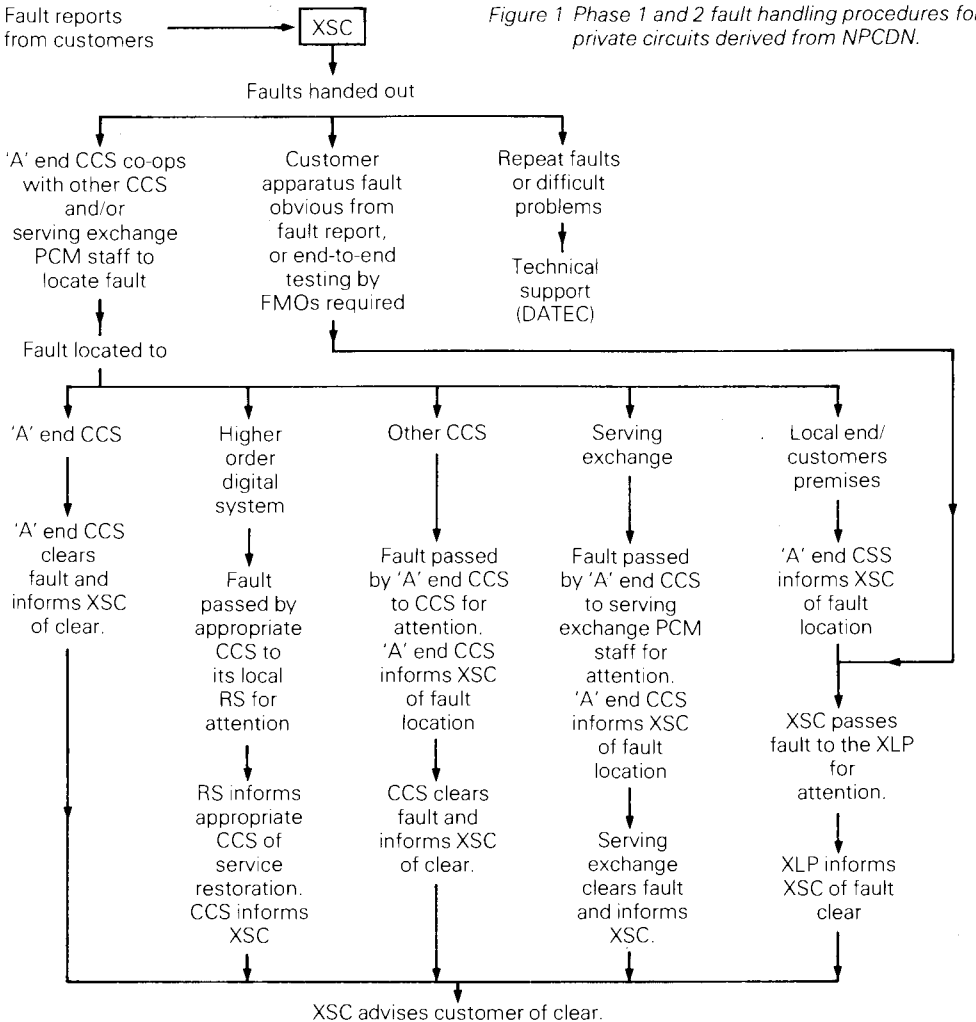


Figure 1 Phase 1 and 2 fault handling procedures for private circuits derived from NPCDN.

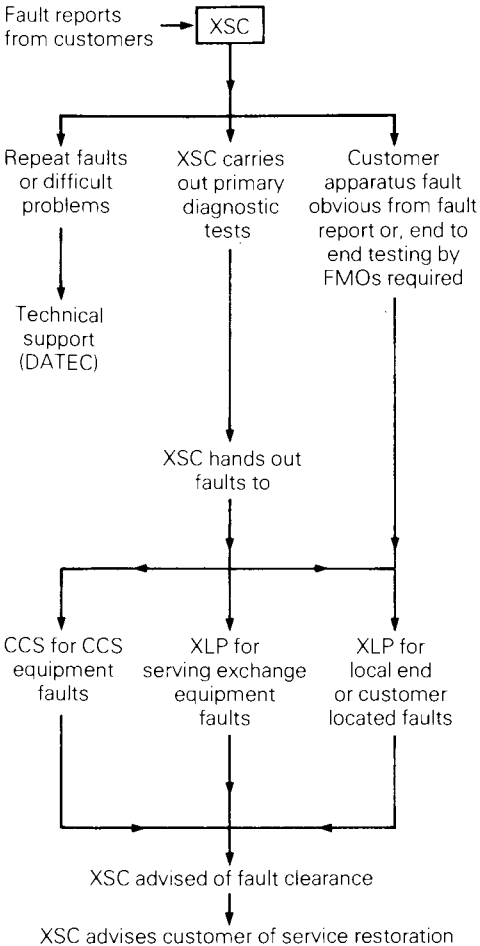


Figure 2 phase 3, 4 and 5 fault handling procedures for private circuits derived from the NPCDN

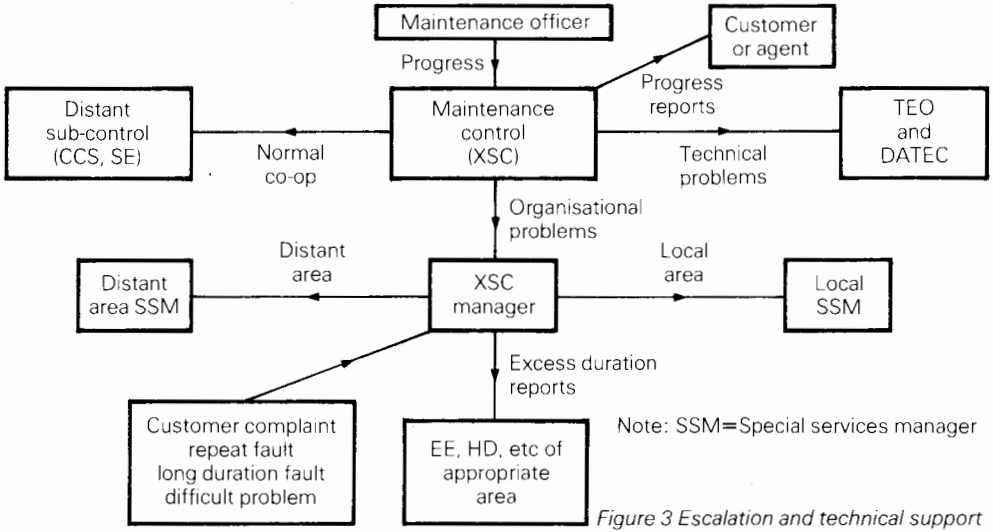


Figure 3 Escalation and technical support

statistics facilities not yet available on CAMSS)
- No circuit test access from XSCs
- Primary diagnostic testing by CCS (co-operation required at customer's premises to apply circuit loop-back on analogue presented circuits)

☐***Phase 2***
- XSCs have fault handling facility added to CAMSS
- customer-located analogue and digital loop-back devices both capable of being remotely activated from CCS and also SE

☐***Phase 3***
- XSCs have test access to all circuits by manually patching circuits to a Remote Access Test Port (RATP) at CCS
- Remote Access Test Equipment System (RATES – see *MN20*) gradually introduced at SEs will give remote test access to analogue-presented circuits
- XSCs have access to circuit/system alarm information.

☐***Phase 4***
- XSCs have the statistics facility added to CAMSS

☐***Phase 5***
- Automatic Cross-connect Equipment (ACE) introduced at CCSs, allowing remote test access to circuits at CCS.

Area X-Stream Liaison Points (XLP)

The detailed operating procedure for each of these phases is too lengthy for this magazine. Although the methods differ due to the availability of diagnostic aids, the primary objectives are the same. Once either the general area of fault, or the faulty item has been diagnosed, fault clearance will be effected most rapidly and efficiently if the fault is passed for attention to staff with the appropriate expertise to deal with the problem. It is essential, therefore, that an XSC hands out faults for attention to the correct point in an Area. Since the duty dealing with any one particular kind of expertise may vary from Area to Area, it is not easy for an XSC to decide who best to pass specific types of faults to within an Area. For this reason, each Area has nominated points – called X-Stream Liaison Points (XLP) – to liaise with the XSC on NPCDN matters.

The XLP will also arrange for staff to go to unattended serving exchanges, and so on, and to arrange field maintenance officer (FMO) attendance at customers' premises as and when required.

Service to the customer

It is essential all staff realise that, in the near future, customers dissatisfied with the service provided by BT will be able to shift their custom to another telecommunications carrier. In maintenance, one way to minimise customer dissatisfaction with service is to keep out-of-service times to a minimum when faults occur. Once a service-affecting fault is reported – or indicated by an alarm, for example – the prime objective must be to restore customer service. Whenever faulty plant can be by-passed, this should be done – the actual fault being cleared subsequent to service being restored.

Future articles will go into more detail on the NPCDN and related topics.

(01-432 9162)

Computer maintenance in British Telecom

by **Kevin Jeffrey** LES4.1.4

This article describes the development of computer maintenance within British Telecom. It outlines our policy, and how we are beginning to implement it by using the existing experience and expertise we can call upon within the Business.

Policy

Up to now it has been the usual practice for computer equipment suppliers to maintain the systems in use by BT. As the number of systems is likely to grow considerably, the question of whether BT should itself assume responsibility for the maintenance of its own computers has been under consideration. Taking into account serviceability, financial factors and staff skills it has been decided that –

- the maintenance of small business computers (SBC) and mini-computers used in-house should be undertaken by BT
- the maintenance of selected computer terminal equipment and in-house should be undertaken by BT
- BT should *not* maintain and repair mainframe computers and their peripherals at the present time. Likewise the maintenance of software should be excluded from the responsibility of area/regional maintenance organisations.

Implementation

Having agreed the principles nationally within BT, the chosen method for implementing the policy is firstly to look at the maintenance and repair for equipment installed on the largest of the national computer-based projects.

BT already maintains and repairs visual display units (VDUs) used with the Telecommunications On Line Data (TOLD) system *(MN9)*. TOLD gives Area office staff communications and computer facilities for entering data directly for subsequent processing. It replaces manual form filling, the use of intermediate data conversion centres, and provides users with on-line interactive checking of their input records. The TOLD system already uses several thousand VDUs.

There are two other large computer projects in the process of implementation, which have significant potential economic benefits to BT in terms of computer maintenance. One is ARSCC: Administration of Repair Service Controls by Computer (see *MN21*). The other is Mechanisation of Order Handling (MOH) – the computerised Advice Note procedure.

The significant feature of the three projects mentioned, is that their implementation injects large volumes of computer equipment into Telecom Area offices, telephone exchanges, telecom engineering centres (TECs) and other locations. TOLD, MOH and ARSCC will account for over 10,000 VDUs within BT – on average 160 VDUs in each telephone area. The projects will also require 3,000 printers – on average 50 in each telephone area. Together with processors, disc drives and magnetic tape drives the three large projects will provide an ideal launch-pad for BT to develop its expertise in computer servicing.

Current Experience

BT has already set up Area Repair Centres (ARCs – see *MN17*) – some equipped with sophisticated automatic test equipment – in the majority of telephone areas and more are proposed. These centres are geared to the repair of electronic equipment, initially on call connect systems and System X equipment. But the facilities which are available, and the skills developed by repair centre staff also form an ideal base on which to build the repair of computer equipment.

Likewise, BT staff have been doing first-line maintenance of Cossor VDUs used on the TOLD project, as well as maintenance of modern telex terminals – Puma and Cheetah which require similar maintenance techniques to printers used with computers.

BT Factories Division provide, a central repair facility for disc drives and processors associated with GEC 2050 computers used in Measurement and Analysis Centres.

The experience gained in organising, supporting and operating the variety of maintenance arrangements for these systems puts BT in an ideal position to expand its computer maintenance activities.

Equipment

BT will be taking over the maintenance responsibilites for computer equipment used on ARSCC AND MOH.

- ARSCC: the VDUs used with ARSCC are supplied by Lynwood Scientific Developments Ltd, and will become a responsibility of BT for

The Lynwood BETA Visual Display Terminal – typical of the equipment now being maintained and repaired by BT.

maintenance and repair from 1 June 1983. BT is in discussion with Honeywell Information Systems Ltd on the handover of maintenance responsibility for their equipment used on ARSCC. The target date for handover of first line maintenance for Honeywell supplied equipment is 1 January 1984.

□MOH: The MOH project calls for equipment to be installed in every telephone area in the UK. Printers installed on this project are supplied by Newbury Data Recording and are BT's responsibility for maintenance and repair from the outset of installation. The remainder of the equipment located in areas on this project will be supplied by Ferranti Computer Systems Ltd, who have proposed a phased handover of the first-line maintenance and repair to BT.

Maintenance and repair

First-line maintenance is being arranged locally, with consulation between Regions and Areas determining the best method. It is essential that staff become expert in a range of peripherals so that restoration of service at a particular location can be accomplished in the majority of cases with one visit. It is planned that repair will be carried out at ARCs.

Training

Maintenance training is being organised by BTTC Stone, and the first computer peripheral (printers and VDU) courses commenced in May 1983. As more equipment falls under BTs maintenance responsibility, necessary training courses will be provided.

The prospects

BT has embarked on a course which aims to build on its existing strengths of a nationwide maintenance and repair organisation and a highly-skilled work force. But we should not lose sight of the fact that this policy only opens up the *option* for BT to undertake this range of work. The extent to which BT actually takes it up will depend – in the final analysis – on whether or not it is economic to do it in-house.

By demonstrating we *can* provide an equal, or better, service than others at a low cost, we can become largely self-sufficient in the field of computer maintenance and build a platform for competitively maintaining other organisations' computers in future.

(01-432 2877)

Progress on implementing the Repair Service Strategy

by **Denis Webb** LES 6.1

The Repair Service Strategy (RSS) was described in the Spring 1981 edition of *MN*. This article describes the progress made towards its implementation in the last two years and reports on early experience of its operation.

The main provisions of the RSS are to raise the quality of the Repair Service and establish a sound basis for BT Inland Division to effectively compete for maintenance work in a liberalised telecommunications environment by:

- establishing a fully integrated repair service directly accessible by our customers at all times
- functionalising RSC duties into reception and record work, and diagnostic testing and distribution work
- providing field technical support and additional fault clearing capability
- modernising RSC equipment and facilities.

Agreement

The two principal unions to the agreement (POEU and UCW) gained acceptance of the RSS proposals at their respective 1981 Summer conferences. After tidying up some points of detail, and extending – for financial reasons – the originally proposed introductory period from 2 to 3-years, the RSS implementing circular S1E8203 was distributed in February 1982.

Programme

The 3-year implementation programme envisages one-quarter of Repair Service Controls (RSC) converted by April 1983; three-quarters converted by April 1984 and complete RSS working by April 1985. Modernisation of RSCs with ARSCC (described in *MN21)* and RLT (described in *MN20)* is expected to be over a five year programme with completion in 1986/87. The table shows the national overall systems provisioning plan.

RSC MODERNISATION

	82/3	83/4	84/5	85/6	86/7
ARSCC SYSTEMS		28	79	79	79
RLT SYSTEMS	6	20	65	132	133

Implementation of the RSS involves solving a lot of inter-related questions about the availability of training places, RSC equipment and accommodation; and for the conversion of indirect reporting RSCs and the introduction of 24-hour working, '151' circuit and exchange remote alarm re-arrangements. So it is not always feasible to introduce simultaneously all features of the RSS at any one location. This has led to the practice of making local progress within overall plans spanning, where necessary, the 3-year period.

An additional complication is that the RSC modernisation programme involving the provision of RLT and ARSCC has become interlaced with the RSS programme. This has resulted in some RSCs being modernised in advance of implementing the RSS.

Each Region has appointed an RSS Liaison Officer to help Areas unravel this complex situation and provide practical assistance with their implementation plans. Quarterly meetings of RSS Liaison Officers are held with Inland HQ to co-ordinate the national programme and allocation of RSC equipment and systems. Repair Service Staff have to adapt to changed working practices as the Strategy is introduced, and for some this can mean up to two months training. The following are the main features –

- after selection, new Customer Service Officers (CSOs) undergo an 8-week training period made up of 2-weeks field training, a 2-week course at either Harrogate (BTNE) or Edinburgh House (BTL) engineering training centres, followed by a further 4 weeks of field training
- Senior Technicians (STs) in RSCs are now required to spend 13-weeks every year in the 'field' on technical support and fault clearance work. A two week TETC course has been provided for those STs who have been away from such duties for more than 2 years and, in consequence, may need updating on the latest customer equipment and field practices
- existing RSC staff have to get used to team working because of the 'functionalising' of work within the controls
- the introduction of 24-hour working at →

selected RSCs has meant staff adjusting their hours of work to provide cover in the evenings, at nights and at weekends
- where ARSCC systems have been introduced RSC staff and managers have had to adjust to using electronically produced dockets, and processing information on VDU screens
- RSC managers must organise the new staffing arrangements to see that it is introduced smoothly and remains effective. A series of one-day courses has been arranged to explain the RSS. Job conference courses covering all aspects of the Repair Service have been provided at Horwood House College.

Progress

In the first year, 40 RSCs, spread out over 22 of the 61 telephone areas, had introduced functionalised RSS working. This number is lower than that envisaged, but there is still a good prospect of completing implementation in the remaining two years. The groundwork for modernising the repair service has been done through successful trials of ARSCC and RLT with some implementation systems in use.

Experience so far shows that the strategy is well received by area management, repair staff and customers.

CSO trainees, including those selected from operating duties, are finding their training to be challenging and stimulating. On becoming part of an RSC team they are making a significant impact on customer service at the fault reception stage of repair service work.

'Pre-strategy' RSC staff have come to accept the new method of working, with its emphasis on team work, in what has been till now virtually an all male preserve. Some staff have had reservations about this aspect of the change, but where the RSS has been implemented they now appreciate both the changed atmosphere and the opportunity to concentrate on the diagnostic testing and fault distribution work of RSCs.

Experienced RSC staff are finding their training course helpful for initiating their return to periods of field duties, which gives more breadth to their work.

Because of the relatively mild Winter of 1982/83 few RSCs were put to the test of having to deal with high fault report rates, but we are confident that those working with RSS will be able to cope much better than those without. The real benefits are most evident at the few RSCs that have introduced functional working with ARSCC. Together these changes enable the RSC to retain control of the fault situation at all times and eliminate the frustrations and inefficiencies caused by manual fault handling systems in periods of heavy fault reporting.

With liberalisation of the supply and maintenance of customer apparatus in prospect, the future for our repair service will be heavily dependent on its ability to respond to customer needs better than any other competing organisation on both quality and cost criteria.

The Repair Service Strategy with its modernisation of RSCs will form a key element in BTs ability to improve the efficiency of its repair service and maximise its share of the maintenance market.

It is heartening that a non-BT person – on recently being shown both pre-strategy and strategy-type RSCs remarked: "The strategy works".

I am sure he is right.

(01-432 2871)

Microfiche document ation for TXE4

by **Ron Webb** LES4.2.1

Following field trials of the use of microfiche documentation in TXE4 (RD & A) exchanges it has now been decided to introduce microfiche as an addition to the standard range of paper copy held in exchanges. The provision is to be at local discretion and Areas have been approached to ascertain their initial requirements.

When Area needs have been collated arrangements will be made for provision of the necessary readers, trolleys and microfiche. It is expected that supplies will become available towards the end of 1983.

A full description of microfiche documentation for TXE4 will appear in a later issue of *Maintenance News*.

(01-432 2481)

Ernie's to blame!

by **Adrian Frame** LES4.2.4

While abbreviations are outside the scope of this article I sympathise with the correspondent (see LETTERS – This issue) who wishes to know the meaning of RWT and FNF. We have grown accustomed to a world of abbreviations and acronyms – some good ones like NATO, LASER and ASLEF have passed into everyday language and are used by people who neither know nor care about the precise significance of each letter. That does not infer that the concepts of western military alliance, coherent light or walking to work are not understood.

The use of acronyms, good and bad, proliferates in British Telecom and it would have come as no surprise to learn of a group of BT bookworms employed only to invent words and give new meaning to old ones.

Having spent fourteen years at school learning that ATE was the past tense of eat I entered the Post Office confident that I knew all there was to know about ATE. Glimpsing the word printed boldly in an Educational Pamphlet my mouth would water at the thought of spotted dick or some other delicacy. To be told that it referred to an indigestible collection of Strowger or Crossbar equipment did nothing for my ego or stomach. Now fully conversant with Automatic Telephone Exchanges I would litter my written work with ATE in the forlorn hope of impressing the Training Officer and utter the hallowed syllables whenever it felt even remotely appropriate. All this idiotic chatter must have baffled employees of Plessey Ltd (ex Automatic Telephone and Electric Co.), bemused those concerned with Artificial Traffic Equipment and infuriated programmers of Automatic Test Equipment. Personally I'd rather have TEA (Test Equipment Automatic) but then I could be referring to a Tunnel-Emission Amplifier. You might think that EAT (Equipment, Automatic Testing) is better but that could be confused with Employment Appeal Tribunal or, in aviation, Expected Approach Time.

Being familiar with PAT, intimate with PAM and wearing a dirty MAC allows me to confuse and embarrass the unfortunates who are ineligible for membership of the Technical Jargon Club. When asked a tough question I can hide behind an obscure acronym, secure in the knowledge that the probability of someone else knowing exactly what it means is very small, while to admit ignorance risks being blackballed. This means that I don't have to know the definition either, although in an emergency one can always make up something with a fair chance of being right.

The problem lies in the method by which acronyms are produced. All too often the "acronymicist" starts with the end product and tends, because it's easier, to choose a word that at best sounds, and at worst is spelt like a word already in use. He then racks his brain trying to make the letters signify words that apply, however loosely, to the product or procedure under consideration. But it is not all gloom and despondency – the mythical BT bookworms have produced wonderful tongue-wrapping words like RERLO (Regional Equipment Repair Liaison Officer) and SPRET (Spare Plant Returns) which are unique in spelling, meaning and pronunciation.

Finally, recent re-organisation has placed sections of what was once THQ into Inland Division Local Exchange Services, making us IDLES – which some of our colleagues in the field have suspected for a long time!
(01-432 2805)

Telegraph Transmission– 'SCVF IN: 80V OUT'–Introduction

by **Benny Goodman** SSE 2.3.1

SCVF (Single-channel voice-frequency) will become the new standard for telegraph transmission. Why introduce it now? The telex network is in the process of modernisation, including the replacement of Strowger exchanges with stored-program control (SPC) exchanges. The traditional 80 volt signals are unsuitable for interfacing modern exchange technology so an alternative had to be found.

The method chosen is known as SCVF and conveys information from a teleprinter over the cable network and is much less affected by cable resistance – allowing the use of longer physical circuits. The system converts the DC 'mark' and 'space' signals into suitably-spaced frequencies for 2-wire transmission over the cable.

Advantages

The advantages of replacing the 80V system with SCVF can be summarised as follows. It:

- reduces interference in an exchange environment that uses modern low voltage circuit technology in its design
- reduces interference problems to other networks using the cable network
- removes the baud speed restriction of 80V signalling
- removes the distance restriction of 80V signalling
- cheaper and more efficient use of power supplies
- the use of lower voltages is more compatible with present safety standards.

SCVF in the telex network

The introduction of SCVF into the network coincides with the relaxation of the BT monopoly on the supply of customer apparatus. In the near future all new telex customers will interface the network with SCVF, and existing customers will have the option to if they so choose.

The planning principle for introducing SCVF into a new SPC exchange area, and an existing Strowger exchange area, is shown in figures 1(a) and 1(b) respectively.

Figure 1(a) shows that for a new SPC exchange area, the Unit Telegraph (UT)54 is used to interface the exchange either directly or through a new design multiplex equipment. Existing customers will be provided with a UT55 prior to exchange change-over, allowing the circuit to continue working at 80V. When required, a unique signal is transmitted from the exchange to the UT55 in the customer's premises to initiate a permanent change-over to SCVF operation.

Figure 1(b) shows how the use of a UT56 will interface a new SCVF customer to an existing Strowger exchange.

During the transitional stages, additional arrangements may be met as shown in Figure 2. Figure 2(a) shows how a customer's SCVF requirement can be met at an outstation with only existing multiplexing equipment available. Figure 2(b) demonstrates how circuit growth in a Strowger exchange will be catered for using new design multiplexing equipment, and a 12/80V converter to interface the low voltage equipment to the exchange.

Description

In the forward signalling direction, the SCVF converter changes DC mark and space telegraph signals, into two different frequencies representing the mark and space signals. In the reverse direction it converts a two different frequencies, representing a mark and space, into DC telegraph signals. The SCVF converter provides a method of simultaneous transmission at speeds of up to 300 bauds over a 2-wire presented, unamplified circuit.

Table 1 summarises the parameters of all three SCVF converters available for use on telegraph circuits. It should be noted that the SCVF converter at the customer's end of the circuit uses the reverse frequencies for transmitting and receiving to that of the exchange-end SCVF converter.

The SCVF converters have a range of strappable options designed to cater for the exchange signalling protocols, including sending a permanent mark or space if the line fails, and the ABS condition.

The line attenuation between two SCVF converters must not exceed 25dB, allowing a

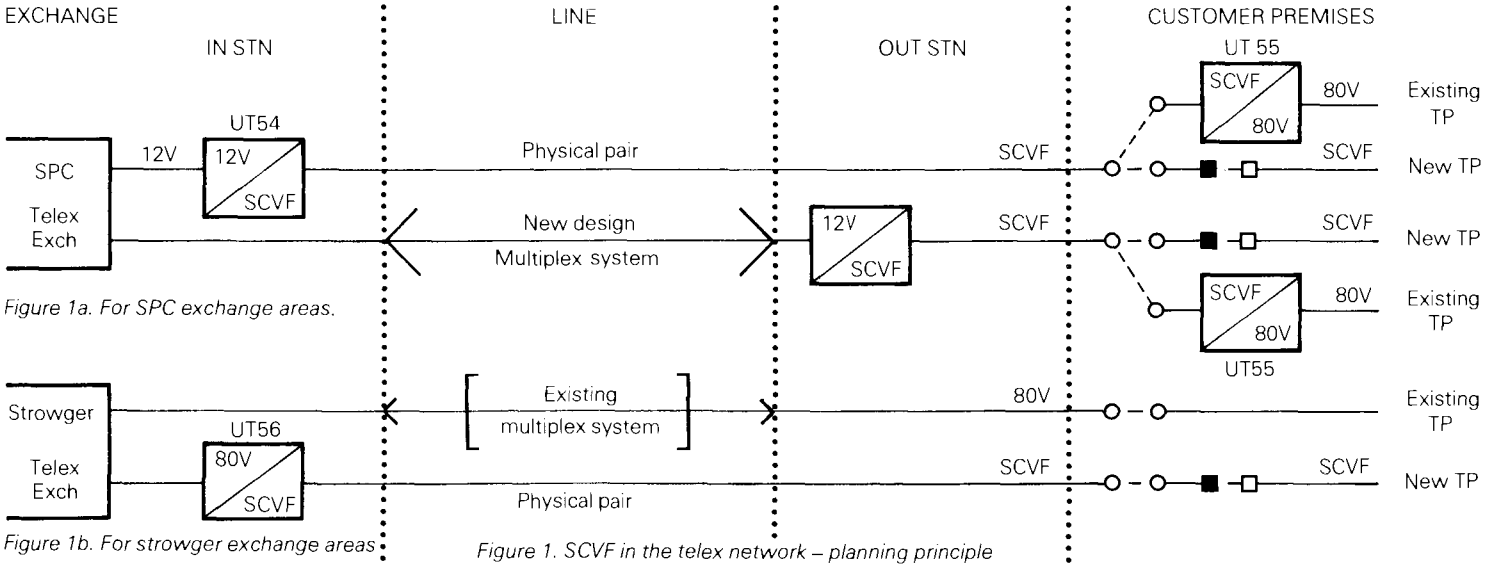


Figure 1a. For SPC exchange areas.

Figure 1b. For strowger exchange areas

Figure 1. SCVF in the telex network – planning principle

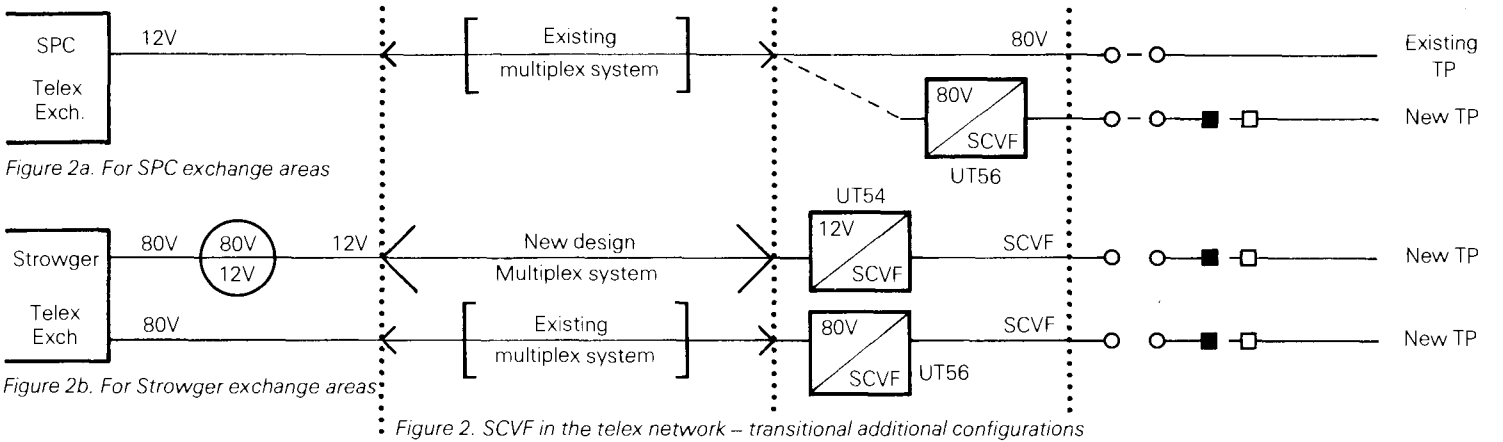


Figure 2a. For SPC exchange areas

Figure 2b. For Strowger exchange areas

Figure 2. SCVF in the telex network – transitional additional configurations

Unit Telegraph No.	Type	Frequencies Transmit (CH1)	Receive (CH2)	TX level	RX level	D.C. Interface	Max. baud speed	Equipment practice
54	B	980Hz 1180Hz	1650Hz 1850Hz	13d Bm fixed	<38 dBm	±12V 4 wire	300	TEP
55	A	1650Hz 1850Hz	980Hz 1180Hz	13dBm fixed	<38 dBm	±12V 4 wire or ±80V 2 wire	−300 −110	Case
56	B	980Hz 1180Hz	1650Hz 1850Hz	13dBm fixed	<38 dBm	±80V 2 wire	110	62 type

Table 1 Unit Telegraph Signal Converters for Telex

5dB margin for maintenance and installation tolerances, giving a maximum tolerable attenuation of 30dB.

If a line attenuation exceeds 25dB, then the circuit can be amplified by using audio 4-wire amplifiers, or by using a circuit in a telephony multiplexer system.

The SCVF converter is capable of supplying line wetting current and this arrangement will be used on all unamplified circuits. In the case of amplified circuits, the method of line wetting will be decided by the circuit design group working to Engineering Performance Specification (EPS) 21.

Maintenance

The use of SCVF in the network will introduce a new facet to telex circuit testing in the test room, reaching out to the field maintenance officer (FMO) traditionally involved with 80V DC line transmission systems.

Test equipment designed for testing SCVF circuits will be provided in the test room and similar facilities will be made available to FMO's.

A plug and socket arrangement will be used to terminate the line in customers' premises. The socket will include contacts which connect a 15Kohm resistor and diode in series across the line when the plug is removed. This facility enables the test desk or transmission terminal engineer to more readily identify line faults without the need for an engineer at the customers' premises.

The telegraph transmission engineer will adapt quite readily to new SCVF transmission systems because of the similarity in principle between SCVF and MCVF (multi channel-voice frequency). New test equipment and test facilities will be provided at transmission terminals enabling SCVF faults to be dealt with quickly and efficiently.

BTTC will be providing the training for SCVF, and this will be made available to staff by Area Training Officers.

Benefits

The introduction of SCVF into the telegraph network, replacing 80 volts, will reduce interference on cable networks, and provide a more suitable interface between modern telex machines and modern telex exchanges. It will also enhance the telegraph private circuit network by providing more flexibility in routing circuits. SCVF will also simplify the connection of telex customers in rural locations.
(01-432 2239)

On reflection.. Here we look back to *MN12* (Autumn 77) and invite some of the authors, or their successors, to comment on their articles..

Don Littlemore RA1.5, updates us on **Electronic PABXs.**

Since the range of first generation electronic PABXs was described in *MN12,* the population has increased to around 1000 systems nationally, the vast majority being stored program control (SPC) types. Products such as the Plessey PDX and GEC SL-1 have developed larger brothers with greater call processing powers. On the other hand the Philips EBX 8000 now has a smaller brother with a simplified configuration for the 'low end' of the market. Also, during that time we have seen BT's own major venture into SPC PABXs with the firm establishment of Monarch and Regent in the market place (*MNs 15* and *20*).

The next generation of systems are already beginning to appear: these new systems offering an increased range of facilities while being more compact and with a lower power consumption. The ability to interface with digital networks (including System X), and the facility to combine data terminal and telephony functions on a single port will feature heavily in new systems.

MN12 talked of the changing skills of PABX staff, and many more staff are by now aware that modern products do offer interest and a challenge. The increased use of private networks (perhaps with inter-register signalling capabilities), the extra complication of customer data management programs, and the new concepts of digital transmission with all their attendant advantages and pitfalls are just a few of the new problems tackled daily by our engineers.

The past five years or so have also seen the emergence of some new Field Support Units (FSUs) set up specifically to deal with field problems which cannot be anticipated by the normal training, documentation and diagnostic packages. Their role is proving essential for the maintenance of computer-type equipment, especially where software plays such a part in the operation of systems.

Our approach to electronic PABXs has enabled us to establish a clear lead over organisations which very soon might be able to compete on equal terms with BT for their maintenance. Systems which we looked at as PABXs in isolation a few years ago, are now becoming the hub of the 'business communications systems' of the future and with efficient collection of maintenance cost data, we will have information to stand us in good stead to cope with further generations of electronic PABXs.

(01-432 2198)

From TI's to IDIS

Brian Grover updates readers on the future of the TI system.

The TI system was introduced in 1972 to bring together the many different series of instructions (including EIs) which had operated in the Post Office prior to the change to Corporation status. The system had many advantages, but it was linked to business and, particularly, area organisation. Over the years – in spite of some successful attempts to rationalise files and so on – it became difficult to control growth of the paper mountain.

At peaks there were 180,000 files, and 30 million pages were being issued each year – including one maintenance TI every day, on average. These disadvantages, combined with the setting up of separate Divisions on the formation of British Telecom, led to the conclusion that a single centralised system of instructions was no longer appropriate. Instead, separate systems related to Divisional requirements should be developed.

As Inland Division had responsibility for more than 80 per cent of TIs – and 95 per cent of files – the development of a new system had to be carefully planned. As an interim measure, the TI system has been continued by the issue of Inland Division TIs. The new system – known as the Inland Division Information System (IDIS) – is now well advanced and will be operating later this year. IDIS will allow flexibility of presentation – such as booklets or maintenance manuals – to meet users' needs. Distribution of copies will be determined locally.

From the statistics already quoted, it is obvious that it will take time and effort to bring IDIS to completion, but the aims are clarity, ease of reference and generally to avoid overloading busy users with unwanted detail.

Further information on the operation of IDIS will be published as the system is developed.

Brian Grover IDP5.1.2

(01-357 2914)

Letters

Abbreviations are fine, but . . .

Maintenance News is read with interest by some BT personnel unfamiliar with the finer points of exchange maintenance and its associated jargon. At least one regular reader finds his interest in technical articles somewhat frustrated by the use of initials, doubtless well understood by maintenance staff.

For instance – David Memory's article 'Maintenance after the Monopoly' uses two abbreviations: RWT and FNF, without explanation.

May I request that, for future articles, abbreviations are written out in full the first time, so that we non-engineers can have a better appreciation of what is being discussed?

L. Hemming, MSP5 QA6.2.1.2
(London Materials Science Section)

—That MN(Maintenance News) is read by non-engineers is flattering but our primary aim is to communicate with maintenance staff. The point made by my QA(Quality Assurance) correspondent is, however, taken seriously, despite my colleague Adrian Frame's light-hearted reminder of this common pitfall (see 'ERNIE's to blame' in this issue). To make amends, RWT and FNF are two of the most used abbreviations in maintenance and refer to categories of fault 'clearance' (something of a misnomer I feel). RWT means 'right when tested'–that the fault was not observed on the first retest following the fault report. FNF – fault not found – means that although the presence of a fault was confirmed, the cause was not definitely located. TI E13 B0013, para 31, refers. I hope this helps. – Editor.

Improved Transit performance

D C White of BTNW comments on the article in issue 21. Whilst agreeing with most of the article I must take exception to the paragraph: Incorrect C digits.

Even though the fault may not be in the incoming RT it is still a 'system' fault and as such attempts should be made to clear it.

In the majority of cases the outgoing end or TSC staff will be oblivious to the fault. If, therefore, the source of the call can be determined the prospect of clearing the fault is vastly improved. Instead of just providing a CO signal for incorrect C digits it is suggested that a 2 digit translation is used to route the call to a spare level. By checking the number of calls on this level 'hard' faults are easily indentified. A special faults-type telephone is now substituted for the spare level R/S, calls answered and the source determined.

An additional aid that we have found useful is an O/L tester for the AC11 register hunters. Basically this uses the call sender of the TRT 118 to pass calls over the RH mult. I will be pleased to supply details to anyone interested.

BTNW
S2232
(061-863 7552)

Ted Lindfield replies . . .

We have tried the idea of translating spare C digits to a telephone, it proved to be time consuming and the time spent was out of proportion to the number of faults located and cleared. We were also unhappy in charging customers for the mis-routed calls, if non metering equipment is used, insufficient time is available for tracing before forced release takes place.

Translating to a spare level or a telephone inhibits repeat attempt, therefore the call must fail. Our method allows repeat attempt and the call will most probably mature satisfactorily.

The objective we set out to achieve was to remove alarm conditions which did not relate to faults within the RT. Those alarms remaining would be meaningful and a worthwhile fault diagnosis could be made, ie genuine equipment faults stand out when alarms due to network problems and customer errors are removed.

Regarding the outlet testing, our investigations revealed a number of register hunter outlet faults which are difficult to locate. BTNWs method should be well worth adopting.

The reference to TI E5H0112, should be E6H0112.

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

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